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VOL. 38. Ser. A. Part 9. pp. 349-384. SEPTEMBER, 1950.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

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BODENHEIMER (F. S.). **Studies on the physical Ecology of the Woolly Apple Aphis (*Eriosoma lanigerum*) and its Parasite *Aphelinus mali* in Palestine.**— *Bull. Rehovot agric. Res. Sta.* no. 43, 20 pp., 6 figs., 6 refs. Rehovot, 1947.

In the Middle East, *Eriosoma lanigerum*, Hsm., is widespread on apple in Turkey, Persia and Upper Egypt, not very common in Lower Egypt and absent from Iraq ; it is usually of secondary importance in the coastal plains of Palestine, but is more important in the north and in the hills. No sexual forms, winter eggs or fundatrices were found in Palestine in observations over many years, and alate females were very rare, except in autumn, when the minimum temperatures ranged between 10 and 15°C. [50 and 59°F.]. The results are given of investigations on the bionomics of *E. lanigerum* and its introduced parasite, *Aphelinus mali*, Hald., on apple at Kiryath-Anavim, near Jerusalem, in 1937–40. The root-collar population of the Aphid (4·9 per cent. of the total) was highest in July and lowest in autumn and winter, the trunk population was never very dense, and the relatively small twig colonies were biggest in early summer and late autumn ; most of the Aphids occurred on the branches, where they were most abundant in spring and least abundant in summer. Fruit infestation in spring was accidental and a sign of a heavy outbreak.

In breeding experiments to study the effects of temperature on the durations of development and life of the two insects, the results of which are given in tables and discussed, the threshold of development of *Eriosoma* was 4·2°C. [39·56°F.] and the number of day-degrees required for an average life-cycle was 256 [460·8]. The corresponding figures for *Aphelinus* were 8·6°C. [47·48°F.] and about 280 [504]. Both are favoured by moderate humidity. It appeared from these and other observations that the optimum conditions for an outbreak of the Aphid are temperatures of 16–20°C. [60·8–68°F.] and 50–70 per cent. relative humidity. Average temperatures above 23°C. [73·4°F.] are unfavourable, as are saturated air and relative humidities below 50 per cent. It is not known whether high temperatures and low humidities have a direct effect on the insect or affect it by changing the condition of the food-plant. The spring temperatures favourable for *Eriosoma* are too low for mass development of *Aphelinus*. Heavy hamsin winds in spring quell outbreaks of the Aphid, but have less effect against the parasite, which does not reach its maximum population until the second half of summer or later. This peak follows the downward trend of *Eriosoma* in June. Intensive parasitism occurs only when the host density is high ; it sometimes reaches 95 per cent. or more when the spring population of Aphids has been abundant.

It is concluded that *Aphelinus* cannot prevent severe spring outbreaks of *Eriosoma*, but that heavy parasitism in summer after they have declined reduces the possibility of autumn outbreaks and also the number of Aphids entering hibernation. The big decline in the *Eriosoma* population in early summer is due to the effect of the spring hamsin winds on the Aphids or the trees or both. Under Palestine conditions, therefore, *A. mali* is only a secondary factor that may slightly reduce the late spring population in normal years, or reduce the residual population between midsummer and winter in years of heavy outbreaks. The other insect enemies of *Eriosoma* in Palestine are also of little importance, *Leucopis puncticornis*, Mg., because of its low population and *Coccinella septempunctata*, L., because it feeds on this Aphid only in years of heavy outbreaks and for short periods. Even during seasons of maximum infestation, a few Aphids in almost every colony escape parasitism by *Aphelinus* ; the subterranean colonies on the root-collar are parasitised only when the soil is removed from them.

Little attention has been paid in Palestine to the selection of immune or relatively immune varieties of apple. When infestation is severe and in years in which outbreaks occur, 0·2 per cent. nicotine sulphate should be added to the

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regular winter spray and sprays containing 0·15 per cent. nicotine sulphate and 1 per cent. summer-oil emulsion should be applied in June, July and September ; the two summer sprays may replace the corresponding lead-arsenate sprays against *Cydia* (*Carpocapsa*) *pomonella*, L. [*cf. R.A.E.*, A **35** 273]. Experiments with DDT dusts and sprays have given unsatisfactory results.

BATCHELOR (L. D.) & WEBBER (H. J.). Ed. **The Citrus Industry. II. Production of the Crop.**—9½×6 ins., xv+933 pp., frontis., 297 figs. (13 col.), many refs. Berkeley, Univ. Calif. Press ; London, Cambridge Univ. Press, 1948. Price 75*s*.

This volume covers all the ordinary orchard practices employed in the production of *Citrus* fruits and includes three chapters on Arthropod pests and their control. In the first of these (pp. 597–625), H. S. Smith describes with special reference to the United States, the development of biological control methods making use of insect parasites and predators, and in the next (pp. 627–664) H. S. Fawcett gives notes on over 60 fungi and some bacteria considered to be parasitic or semi-parasitic on pests of *Citrus*. The third chapter (pp. 665–812), by A. M. Boyce, contains information on the insects and mites that attack *Citrus* in different parts of the world, including, for the more important, accounts of their appearance, bionomics and control, together with descriptions of the control methods, insecticides and equipment for their application employed in the *Citrus*-growing areas of the United States. Smith (pp. 813–830) also contributes a discussion of the value of plant quarantines in preventing the introduction of specific insects and fungi, the possibility of eradicating an introduced pest or disease, the methods by which plant quarantines can be enforced, and their use as an agricultural policy.

GRIOT (M.) & ICART (A.). **Observaciones sobre un parásito del " bicho de cesto "** *Psychidosmicra brasiliensis* (**Brèthes**). [Observations on a Parasite of *Oiketicus kirbyi*, *P. brasiliensis*.]—[*Publ.*] *Inst. Sanid. veg.* (A) **3** no. 32, 13 pp., 10 figs., 4 refs. Buenos Aires, 1947.

Three species of *Psychidosmicra*, *P. brasiliensis*, Brèth., *P. australis*, Blanch., and *P. brethesi*, Blanch., of which the first is the commonest and most effective, parasitise the larvae of *Oiketicus kirbyi*, Guild., in central Argentina. They also occur in Uruguay, and records of their distribution in the two countries and a key to them based on the work of Blanchard [*R.A.E.*, A **24** 381] are given. These Chalcids have no other known host, and their habits are similar. The eggs and larvae of *P. brasiliensis* are described. Insectary investigations on its bionomics showed that the adults are sluggish and require 5–10 days to become sexually mature. A dissected female contained 288 eggs. They fed on a mixture of agar, sugar and honey, or on wild flowers, and survived for 10–20 days in weak sunlight or semi-shade. When larvae of *O. kirbyi* in their bags were introduced into the cage on leaves, the females oviposited in them after some delay, inserting the ovipositor into the abdomen through the wall of the bag. Only one egg was laid in each. Larvae in bags greater than 1 cm. in size were not attacked. The original adults had emerged mostly in November, at about the time that the host appears in the field, the eggs hatched in 5–8 days, and the first pupae were observed on 5th September following. Pupation occurred outside the host but within the bag.

The percentage parasitism in nature reached 35 and even 80 in some places, but was much lower in others. Factors tending to limit the population were desiccation of parasitised host larvae during the winter, causing the death of the parasites in them, destruction of the full-fed larvae and especially the pupae by *Pediculoides ventricosus*, Newp., and parasitism by *Tetrastichus pseudoeceticola*, Blanch. [*cf.* **34** 300], which destroyed some of the larvae and pupae.

SILVA (P.). **Controle biologico da "traça do cacau" pelo** *Microbracon hebetor* **(Say).** [The Biological Control of the Cacao Moth by *Bracon hebetor*.]—*Bol. tec. Inst. Cacau Bahia* no. 7, [1+] 39 [+1] pp., 14 pls. (2 fldg.), 1 fldg. map, 9 tables (3 fldg.), 53 refs. Bahia, 1947. (With a Summary in English.)

In 1942, when large stocks of cacao beans in the State of Bahia, Brazil, had to be kept in store because of lack of shipping, serious infestation by *Ephestia* developed, and the author was appointed to investigate possible methods of control. The species of *Ephestia* in cacao in Brazil had previously been recorded as *E. elutella*, Hb. [*cf. R.A.E.*, A **23** 593 ; **29** 616], but examination of samples from large warehouses in Ilhéus, Itabuna and Pirangí showed that *E. cautella*, Wlk., was the only species involved. It was parasitised by *Bracon* (*Microbracon*) *hebetor*, Say, in many instances. The habits of *E. cautella* are briefly described. The larvae cannot enter cacao beans that are not injured, and in tests, beans fermented for a week were the most resistant to attack and those fermented for four days the least so. Under local conditions, the eggs hatched in 3–4 days, the newly hatched larvae survived for up to 24–48 hours without food, and the larval stage lasted 40–42 days in December–January, 40–55 in January–March and 60–73 in May–August. Pupation takes place on the outside of the bags in which the cacao is stored, and the pupal stage lasted 10–12 days.

Since the warehouses were not suitable for fumigation, attention was directed to the parasite, *B. hebetor*. All its stages are described, Portuguese translations are given of its original description and of the sections dealing with it in a key in a paper by Muesebeck [**13** 411], and the main hosts from which it has been recorded in various parts of the world are shown in a table. Prior to the author's investigations, the only record of it in Brazil was from *Platyedra gossypiella*, Saund., in cottonseed [**26** 704], but in addition to numerous examples from *E. cautella* in stored cacao, he reared a few from larvae of *Myelois duplipunctella*, Rag., in dried cacao fruits in the open. In laboratory experiments, a female of *B. hebetor* paralysed but did not oviposit on a larva of this Pyralid, a larva of *Hypsipyla grandella*, Zell., was entirely neglected, and normal parasitism was obtained in *Galleria mellonella*, L. No predators or parasites of *B. hebetor* were found.

In rearing experiments on *E. cautella*, the results of which are discussed in relation to the literature on the bionomics of *B. hebetor* [*cf.* **22** 349 ; **25** 627, 629 ; **30** 404 ; **31** 197], the females oviposited 2–3 days after emergence, laying from 90 to several hundred eggs each at rates of 1–18 per host larva. The larvae migrated over the body of the host, killing any individuals of their own species encountered, and died if transferred to an unparalysed host. Development from egg to adult lasted 10–20 days at 25·1–22·6°C. [77·18–72·68°F.], with an average of 14·25 days, and the egg, larval and pupal stages averaged 1 day 8 hours, 5 days 10 hours and 7 days 10 hours, respectively. Males survived for about 9 days and females for about 20, whether kept in the light or the dark and whether given honey and water or kept without food. The females readily found suitable hosts and penetrated the cloth coverings of jars containing infested cacao beans. In an experiment in which 31 infested cacao beans were mixed with 400 sound ones in a jar and the whole exposed to ten fertilised females of *B. hebetor*, three healthy larvae and two pupae and 26 parasitised and dead larvae of *E. cautella* were found after four days. The females sucked the juices from the host larvae that they paralysed but did not oviposit in all of them. Unfertilised females gave rise to male progeny only, and the sex ratio varied with the time of year, males constituting about 70 per cent. of the population in winter and about 50 per cent. or a little less in summer. The parasite was not found in warehouses that did not contain cacao, and was probably attracted by volatile substances present in the beans.

In view of the apparent suitability of *B. hebetor* for the biological control of *E. cautella*, laboratory breeding on a large scale was begun late in 1942. The most suitable laboratory host was *E. cautella* itself; paralysed larvae of *Galleria mellonella* decomposed before parasite development was complete and larvae of *Plodia interpunctella*, Hb., proved difficult to handle owing to their spinning habits. Adults of *E. cautella* were allowed to oviposit on black paper in inverted jars containing honey and water, and the larvae were transferred on hatching to larger jars containing maize meal, which proved the best food for rapid development. When they became full-fed, batches of six were exposed to pairs of fertilised females of *B. hebetor* in tubes. Parasitised examples were removed every other day, and fresh hosts supplied. Surplus eggs were transferred to hosts on which few had been laid. The parasitised larvae were placed in paper containers, in which the parasites pupated, and these were distributed to the cacao warehouses. In all, nearly 22,000 were released in 1942–45. Some losses of host material in the laboratory were caused in 1944 by the predacious Carabid, *Plochionus pallens*, F. It is concluded as a result of the work that *B. hebetor* is capable under favourable conditions of controlling *E. cautella*. The percentage parasitism obtained usually exceeded 50.

PINTO DA FONSECA (J.). **Criação da vespinha africana, no Instituto Biológico.** [The Rearing of *Tetrastichus giffardianus* at the Biological Institute.]—*Biológico* **13** no. 9 pp. 147–156, 7 figs., 1 ref. São Paulo, 1947.

The author recapitulates the history of the introduction of *Tetrastichus giffardianus*, Silv., into São Paulo for liberation against *Ceratitis capitata*, Wied., on various fruits and the methods used to breed it in the laboratory [*cf. R.A.E.*, A **29** 344 ; **32** 108, etc.]. By August 1947, about a million examples had been reared and 452,000 released on 395 properties in the State. Consignments of the Eulophid had also been sent to other Brazilian States and to Uruguay, Argentina and Colombia.

WIGGLESWORTH (V. B.). **The Site of Action of inert Dusts on certain Beetles infesting Stored Products.**—*Proc. R. ent. Soc. Lond.* (A) **22** pt. 7–9 pp. 65–69, 2 figs., 3 refs. London, 1947.

In order to obtain information on the site of action of inert dusts on insects that infest stored products, adults of *Tenebrio molitor*, L., *Rhizopertha dominica*, F., *Calandra granaria*, L., *Anobium punctatum*, Deg., *Tribolium confusum*, Duv., and *Ptinus tectus*, Boield., were kept in contact with alumina (aluminium oxide) for 48 hours and the extent to which the dust abraded the protective wax layer of the cuticle [*cf. R.A.E.*, A **33** 188 ; **34** 61] was investigated by means of a silver-staining technique [**33** 188] ; small darkly-coloured insects were bleached in a strong solution of hydrogen peroxide after immersion in the staining solution to render the stained areas clearly visible. In all the insects, the wax layer of the cuticle was abraded chiefly in the articulations of the limbs, though other points where the soft cuticle rubbed against the dust when the insect was moving or where the dust got into other joints were also abraded to some extent. The abraded areas were most extensive in *Tribolium* and *Tenebrio*, and specific differences may in part be due to differences in activity. Normal adults of *Tenebrio* living in flour or bran sometimes showed very slight abrasion with increasing age.

OLDROYD (H.). **A new Species of** *Systoechus* **(Diptera : Bombyliidae), bred from Eggs of the Desert Locust.**—*Proc. R. ent. Soc. Lond.* (B) **16** pt. 7–8 pp. 105–107, 2 figs., 3 refs. London, 1947.

HYNES (H. B. N.). **Observations on** *Systoechus somali* **(Diptera Bombyliidae) attacking the Eggs of the Desert Locust** (*Schistocerca gregaria* **(Førskål)) in Somalia.**—*Proc. R. ent. Soc. Lond.* (A) **22** pt. 7–9 pp. 79–85, 3 figs., 5 refs. London, 1947.

In the first paper, *Systoechus somali*, sp. n., is described from adults of both sexes reared by Hynes from eggs of *Schistocerca gregaria*, Forsk., in Somalia in 1945, and two females, thought to be of this species, are recorded from Kenya, where they were collected by D. L. Gunn.

The second paper contains an account of observations on the bionomics of this Bombyliid, made during 1945 in the Ogaden Province of Somalia, where the rains normally occur, and *S. gregaria* oviposits, during May-June and again in October-November. It was first observed in May-June, when larvae, all of the third instar but differing considerably in size, were found in egg-pods of the locust that had been deposited five or more days before. Each egg-pod contained about 70 eggs of *Schistocerca* and from 0 to over 30 larvae of the Bombyliid, though the usual number of the latter was less than ten. It seemed that about 5–6 larvae could destroy all the eggs in a pod, and it is not known whether more could complete their development. Unattacked locust eggs hatched 13–15 days later, and after a few more days, the Bombyliid larvae left the egg-pods and remained for some months close by them in small ovoid cavities in the soil. Two months later, the larvae were still in diapause in the dry soil and appeared unchanged, though they were somewhat shrunken.

The climate and topography of Somalia are very uniform, and eggs of *Schistocerca* were widely distributed in both May–June and October–December. In both periods, however, the Bombyliid was numerous only in a relatively small area, which was one of very few in which the locusts always oviposit when they do so at all in the colony. The percentages of the egg-pods attacked were highest in hard soil and very low in soft, sandy, soil ; in an area of hard clay with sandy patches over which the pods were fairly evenly distributed, the percentages attacked in early June and (in brackets) the average numbers of larvae per pod were 96 (4) in the clay and 32 (1·6) in the sandy soil. In another area, where all the pods were attacked and contained an average of 18 larvae each, no eggs hatched. In October–December, when locust eggs were deposited in eight different areas within a total area of 254 square miles, 40 per cent. of those in soft soils and 100 per cent. in hard were destroyed, and relatively few hoppers hatched.

In a laboratory experiment, some 1,400 parasite larvae in diapause that were collected at the end of July 1945 from a site on which locusts had oviposited in May were placed in dry soil in four well-drained trays on 13th August and kept under observation for a year. The soil in the different trays was kept permanently saturated or permanently dry, or watered heavily or lightly at monthly intervals beginning on 12th September. Adults began to emerge from the saturated soil within a few days of the initial watering. At the end of the year, none had emerged from the dry soil, though over 40 per cent. of the larvae were still alive, and only three from the lightly watered soil, in which over 30 per cent. of the larvae were still alive, but there had been fair emergence (a total of 38 adults) from the saturated and heavily watered soils, and both contained many living larvae ; mortality was heaviest in the saturated soil. Almost all the adults emerged during October–November or May–June, From this experiment, it is concluded that rain is necessary to break diapause. but that the adults emerge only during the normal rainy seasons, when

oviposition by locusts may be expected, even if there should be rain at other times ; rain too light to induce oviposition by locusts would not cause emergence. Some larvae remain in diapause despite conditions favourable for emergence, and since *Schistocerca* may be absent from Somalia for several years, it is possible that the Bombyliid remains in diapause from one outbreak till the next. It is more probable, however, that populations are maintained on grasshoppers in the years when locusts are absent. Pupation takes place in the soil cavities. The duration of the pupal period could not be determined directly, but was less than 9–15 days under laboratory conditions.

An account by Gunn of presumed oviposition in the field in Kenya is quoted ; the fly hovered just above the locust egg holes and appeared to project eggs into them while doing so.

FORD (R. L. E.). **The Use of common Salt for keeping down Vegetable and other Moulds during Breeding Experiments.**—*Proc. R. ent. Soc. Lond.* (A) **22** pt. 7–9 pp. 86–88, 1 graph, 1 ref. London, 1947.

High mortality is often caused among insect larvae that are being reared in large numbers under artificial conditions by the development of moulds on the leaves on which they feed and on their excrement. This difficulty, which is especially great in the case of small caterpillars in flowers or rolled leaves, can largely be overcome by spraying the leaves or flowers with a solution of common salt in water. In tests with larvae of *Argyresthia goedartella*, L., in birch catkins, *A. laevigatella*, H.-S., in larch shoots, *Gracilaria syringella*, F., in rolled leaves of privet and *Cnephasia incertana*, Treitschke, in spun flowers of buttercup, the combined emergence of these insects and their solitary parasites was increased from 7–20 to about 80 per cent. by the use of solutions containing 2–3·5 per cent. salt. The material containing the larvae was kept in unglazed earthenware pans about 12 ins. in diameter and 5 ins. deep and containing a one-inch layer of sterilised sand. Each pan accommodated up to 500 larvae and was covered with a sheet of glass that was turned over each day to disperse the moisture condensed on it. Where emergence was protracted, a second application of the salt solution was necessary. Stronger solutions and finely granulated salt crystals sprinkled on the leaves killed the larvae, and salt crystals were less effective against the mould than solutions. Larval excrement left in the pans at times when it is inadvisable to disturb the larvae for cleaning can also be kept free from mould by this method. Larvae burrowing into soil or pupating media present in the pans at the time of treatment are not affected.

PIELOU (D. P.). **Observations on the Behaviour of gregarious Hoppers of the Red Locust, *Nomadacris septemfasciata* Serville.**—*Proc. R. ent. Soc. Lond.* (A) **23** pt. 1–3 pp. 19–27, 3 figs., 5 refs. London, 1948.

An account is given of observations and field experiments on the effect of various stimuli on the behaviour of young hoppers of *Nomadacris septemfasciata*, Serv., made during a campaign against them in the Rukwa Valley, Tanganyika, in 1946–47. The eggs from which the hoppers hatched had been laid in bush at the foot of the western escarpment, not on the grassy plains round the lake that form the normal hatching grounds ; and the hoppers, which were of phase *congregans* near *gregaria*, formed small bands, 1–5 yards in diameter and spaced roughly 100 yards apart, in open woodland in which dense grass 4–8 ft. high had sprung up after the rains began. The bands moved to new feeding and basking sites each day, generally early in the morning, when they covered distances of 5–20 ft. They did not feed in the intervening spaces, so that the

past movements and approximate size and density of a band could be determined from the successive patches of damaged grass left by it. The hoppers usually rested low in the grass at night, but by day generally clustered on the tops of the grasses or along their stems. They showed a tendency to move southward that could not be related to the position of the sun. If disturbed, some jumped to lower levels in the grass and the rest hopped away in a burst of activity that lasted several seconds and was sometimes renewed without any further obvious disturbance. In heavy rain, many sheltered on the lower side of bent leaves.

In experiments with caged hoppers, light, gravity and temperature were all found to be marked factors in the behaviour responses. Both general activities and susceptibility to stimuli increased with rising temperature, and this is probably largely a physiological response, though it is difficult to separate the sensory and physiological effects when considering undirected reactions to temperature. Radiant heat has almost certainly a direct influence on activity. Light exerted a direct effect on the activity of the hoppers (photo-orthokinesis), which is probably significant in the early morning before air temperature begins to rise appreciably. It also induced an undirected, wandering response (photo-klinokinesis), which is the most important factor causing the frequent movements that generally keep the hoppers in sunlit places ; on some terrains these are partly due to differences in the types of movement exhibited in sunlight, where crawling was rare, and in shade, where it was frequent. A direct orientation to a source of light (phototaxis) was made, but did not seem to be of importance under the environmental conditions observed. A strong tendency to move upwards was shown to be a negative response to gravity (geotaxis). It was more apparent in the light than in the dark, but this is attributed, not to a positive stimulating effect of light, but to meandering klinokinetic movements that are an immediate response on entering darker conditions and that delay and mask the geotactic effect until the hoppers have become adapted to the dark. The wanderings of small bands could not be correlated with the direction of the sun or any obvious feature of the vegetation or terrain.

Broadbent (L.), Doncaster (J. P.), Hull (R.) & Watson (M. A.). **Equipment used for trapping and identifying alate Aphides.**—*Proc. R. ent. Soc. Lond.* (A) **23** pt. 4–6 pp. 57–58, 3 figs. London, 1948.

The fixed adhesive trap first used by the authors to capture alate Aphids [*R.A.E.*, A **36** 195] was later replaced by one with a cover that could be removed and sent to the laboratory, thus eliminating the need for visits by an entomologist. It consisted of a one-foot length of galvanised iron stove-piping (usually 5 ins. in diameter) painted white and fixed round a wooden post at any desired height. A transparent plastic sheet coated with a layer of grease-banding material 1 mm. in thickness is wrapped round it and held in place by a strip of brass bent over the top of the trap and fitted into a socket at the bottom. The Aphids remain sufficiently well preserved for identification for a fortnight unless the weather is hot and dry. The equipment and technique used for freeing the Aphids from grease and storing them in phenol are described.

Breese (M. H.). **Notes on the Oviposition Site and Method of Reproduction of the Weevil** *Strophosomus melanogrammus* **(Förster) (Col.).**—*Proc. R. ent. Soc. Lond.* (A) **23** pt. 4–6 pp. 62–65, 9 refs. London, 1948.

Strophosomus melanogrammus Först. (*coryli*, F.) is common in Britain on a number of food-plants, chiefly oak, hazel [*Corylus*] and pine, but is rarely of

economic importance, though it is a pest of pine culture in Germany [*cf. R.A.E.*, A **17** 58]. Oviposition has been recorded as occurring on or in the soil or on low-growing plants, but in tests here described, in which the weevils were kept in lamp glasses over flower pots containing either fine, sterilised soil and young pine shoots, with or without grass or lettuce seedlings, or turf and oak shoots bearing opening buds, eggs were deposited only beneath bud scales or in other protected positions on the shoots. In the field, eggs were found below bud scales on oak, but none could be found on pine.

The literature contains conflicting reports regarding the existence of males in this species and an indication that the females may mate with males of *S. capitatus* var. *rufipes*, Steph. Of 327 examples collected in the London district in the autumn of 1946, all were females, and since the spermathecae of over 100 that were dissected were empty, it was concluded that the over-wintering females have not been fertilised. Of 75 kept throughout the winter, 28 survived and oviposited, and 90 per cent. of the eggs hatched. A further 44 weevils collected in spring were all females. After April, two mating pairs were taken at Ascot. The females were *S. melanogrammus*, but the males could not be distinguished from those of *S. c. rufipes*. Both the females had empty spermathecae ; one was dissected immediately and the other after it had laid eggs, which did not hatch. Of about 250 females collected in the same localities between April and July and dissected, only one had been fertilised. Males of *S. c. rufipes* mated with females of *S. melanogrammus* in small tubes, but fertilisation did not occur. It is concluded that in the areas investigated, *S. melanogrammus* is normally parthenogenetic, but that the possibility of the existence of males is not excluded. On the analogy of other weevils, unfertilised eggs would give rise to females and fertilised ones to both sexes. The contradictory reports of the occurrence of males of *S. melanogrammus* in northern Europe suggest that this is the case.

YEAGER (J. F.) & MUNSON (S. C.). **Relationship between Knockdown and Survival Time for DDT-poisoned Flies and Roaches.**—*J. econ. Ent.* **42** no. 6 pp. 874–877, 1 graph, 7 refs. Menasha, Wis., 1949.

The following is based on the conclusions drawn by the authors from experiments in which DDT in maize oil was injected into large nymphs of *Periplaneta americana*, L., and others in which adults of *Musca domestica*, L., received an application of the same solution on the dorsal surface of the thorax from a calibrated wire loop. When the survival times of the flies are plotted against concentration, the curves obtained are hyperbolic, show no inflection of the kind previously reported for *P. americana* into which sodium metarsenite dissolved in saline solution has been injected [*R.A.E.*, A **33** 64 ; *cf.* also **35** 116 ; **38** 36], and can be described by the equation $(c-c_0)(t-a)=K$, where a, c_0 and K are constants and c_0 is negligibly small. When concentration is plotted against knockdown, the curves are similar in form, show no inflections and can be described by the same equation when a and c_0 are both made negligibly small.

The difference between time for knockdown and time for death is approximately constant in the range of lethal concentration, when allowance is made for random experimental errors, whereas the toxic action of the DDT leading to knockdown is a function of the applied concentration. This suggests that the lethal action of the DDT, once the knockdown stage of poisoning has been reached, may proceed independently of the concentration administered. Less precise data for the cockroaches suggest that the same conclusions may apply, but in this case the experimental error was great.

Hills (O. A.) & Taylor (E. A.). **Effect of Curly Top-infective Beet Leafhoppers on Cantaloup Plants.**—*J. econ. Ent.* **42** no. 6 pp. 897–900, 2 figs., 3 refs. Menasha, Wis., 1949.

The following is based on the authors' introduction and summary. Observations over a period of ten years in the Salt River Valley of Arizona indicated that the curly-top virus transmitted by the beet leafhopper (*Circulifer tenellus*, Baker) may be present in cantaloupe melons without producing reliable or even recognisable symptoms, so that its importance in the production of the crop in this area is not clearly understood. Experiments were therefore carried out in the spring and summer of 1948 to determine the effect of curly top on the young plants. Caging of infective leafhoppers on plants in the cotyledon and two-leaf stages of development resulted in drastic stunting or eventual death of every plant in the former stage and less drastic retardation in growth with no mortality in the latter. When single infective leafhoppers were allowed to feed for 24 hours on plants in the cotyledon stage, some of the plants were severely stunted, whereas others did not appear to be affected. The results indicated that cantaloupe plants of the variety tested developed some resistance to the curly-top virus between the cotyledon and two-leaf stages of development and that some plants in the cotyledon stage apparently tolerated the feeding of one infective leafhopper for 24 hours. No symptoms characteristic of the disease developed in any of the plants, even those that were retarded in growth, drastically stunted or killed.

Floyd (E. H.). **Control of the Sand Wireworm in Louisiana.**—*J. econ. Ent.* **42** no. 6 pp. 900–903. Menasha, Wis., 1949.

The following is largely based on the author's introduction and summary. *Horistonotus uhleri*, Horn, is perhaps the most destructive soil-inhabiting insect in Louisiana [*cf. R.A.E.*, A **29** 602]. It occurs in the northern part of the State, chiefly in hilly, sandy ground. It was not known to occur in valleys until the summer of 1947, when extensive areas in the valley of the Red River were found to be heavily infested ; the soil of these areas contained a high proportion of sand. In 1947, treatment of the soil with BHC (benzene hexachloride) applied along the rows at a depth of 8–10 inches at the rate of 4, 8 or 16 oz. γ isomer per acre on 12th May gave complete protection of maize plants grown from seed sown the same day about 2–4 inches above the chemical, although adjacent untreated maize was severely affected, often to the extent of total destruction of the plants. Yields were 26–35 bushels per acre on treated plots and averaged 2 bushels per acre on untreated ones. Maize grown in 1948 on ground treated with these dosages of BHC in the spring of 1947 produced an average of 21 bushels per acre. The plots were free of the wireworms throughout the season, showing that BHC is effective during the second crop season after application. Untreated plots were heavily infested and produced an average of 9 bushels per acre. Treatment with 5 lb. technical DDT per acre and 5 lb. technical toxaphene per acre also gave promising results.

In large-plot treatments in 1948, dosages of 4–16 oz. γ BHC, 2·5 lb. technical chlordan and 25 lb. technical DDT per acre, mixed with sandy soil or with a complete fertiliser and applied with a one-row fertiliser distributor, all gave highly effective control of *H. uhleri*. The fertilisers and insecticides were apparently compatible. When broadcast by hand the autumn before planting, BHC gave complete protection of maize from the wireworm at dosages as low as 2 oz. γ isomer per acre. Yields averaged 38 bushels of maize from treated plots and 12 bushels from untreated ones.

Newson (L. D.) & Smith (C. E.). **Destruction of certain Insect Predators by Applications of Insecticides to control Cotton Pests.**—*J. econ. Ent.* **42** no. 6 pp. 904–908, 12 refs. Menasha, Wis., 1949.

In 1947, when the new chlorinated insecticides came into general use on cotton in Louisiana, the occurrence of some unusual outbreaks of pests suggested that these insecticides might be seriously detrimental to the natural enemies of these pests. Damaging infestations of the second generation of *Heliothis armigera*, Hb., which does not usually injure cotton in Louisiana, developed in fields that had received applications of a dust containing 5 per cent. DDT and 3 per cent. γ BHC (benzene hexachloride) against *Psallus seriatus*, Reut., and severe bollworm infestations also developed after 3–5 applications of either this mixture or 20 per cent. toxaphene dust against the boll weevil [*Anthonomus grandis*, Boh.]. No damage by *Heliothis* occurred in scattered fields that had not been treated with insecticide. Heavy infestations of *Tetranychus bimaculatus*, Harvey, occurred in many fields in which the new organic insecticides had been used.

In 1948, data were collected on the effect of some of the more commonly used cotton insecticides on the populations of predators that are frequently found in cotton fields in Louisiana and destroy mites and eggs and small larvae of *Heliothis*, as well as *Aphis gossypii*, Glov., outbreaks of which on cotton are known to favour infestation by *Heliothis* [*R.A.E.*, A **37** 160, etc.]. These included the Coccinellids, *Ceratomegilla* (*Coleomegilla*) *maculata*, Deg., *Hippodamia convergens*, Guér., *Cycloneda sanguinea*, L., *C. munda*, Say, *Scymnus creperus*, Muls., and *S. loewi*, Muls., the Anthocorid, *Orius insidiosus*, Say, and the Lygaeid, *Geocoris punctipes*, Say. Dusts were applied against *Anthonomus grandis* in the late afternoon at intervals of 4–5 days, and the new organic compounds proved to be more detrimental than calcium arsenate (with the addition of nicotine in alternate applications) to populations of *G. punctipes* and *O. insidiosus*, but not to the Coccinellids ; 20 per cent. toxaphene with 40 per cent. sulphur was the most destructive dust tested, consistently reducing the numbers of the two bugs below those on plots treated with calcium arsenate and nicotine. A mixture of 3 per cent. γ BHC, 5 per cent. DDT and 40 per cent. sulphur significantly reduced the populations of *G. punctipes* in three experiments and of *O. insidiosus* in one, and 10 per cent. chlordan significantly reduced the numbers of *G. punctipes* below those on calcium-arsenate plots. All treatments reduced populations of both bugs and Coccinellids below those on untreated plots. In one field that had been uniformly treated as to time of planting, fertilisation and cultivation, eight applications of calcium arsenate and nicotine, or of BHC, DDT and sulphur, made with a rotary hand duster beginning on 7th July were compared with five made with a power duster beginning on 19th July. A damaging bollworm infestation developed in all the plots of the first experiment, but not in those of the second. It is concluded that although populations of beneficial insects depend on a complex of factors, the chlorinated compounds that are being generally recommended as cotton insecticides may be expected to have a serious effect on the balance that normally exists between them and such pests as *Aphis gossypii*, Tetranychids and *Heliothis*.

Floyd (E. H.) & Smith (C. E.). **Control of the Southern Corn Rootworm and the Seed-corn Maggot in Louisiana.**—*J. econ. Ent.* **42** no. 6 pp. 908–910. Menasha, Wis., 1949.

The results are given of investigations in 1948 on the extent of the damage caused to seedling maize by *Diabrotica undecimpunctata howardi*, Barber (*duodecimpunctata*, auct.) and *Hylemyia cilicrura*, Rond., in Louisiana, and

on their control. The severity of attack by both species is known to be increased by sowing the maize too soon after the ploughing under of a green manure crop or by a late and wet spring. The treatments were applied on 23rd March in a field in which a heavy crop of vetch and winter peas had been ploughed under six days before. BHC (benzene hexachloride), technical chlordan and technical DDT were mixed with fertiliser, applied at 300 lb. per acre, to provide dosages of 1 lb. γ isomer and 5 and 25 lb. technical compound per acre, respectively, and other plots received an application of the fertiliser alone, or of tung-nut hull meal at 30 lb. per acre, or no treatment. The seeds were sown about two inches above the fertiliser on the same date. Plants in plots treated with chlordan, BHC and DDT grew faster and larger than those in the other plots from the time they were 2–3 inches high until they were about 2–3 ft. high, after which all plants became more uniform in development.

Injury by *Diabrotica* consisted of a hole bored through the stalk just below soil level, which often cut the centre bud, as a result of which the heart of the plant wilted and died ; although the plants often continued to live and put out suckers at ground level, they produced no grain. *Hylemyia* fed on the hypocotyl, often severing the seed from the upper part of the plant ; the damage resulted in a general weakening and dwarfing of the plants owing to interference with the translocation of food, though the plants tended to outgrow the dwarfed condition after the development of secondary roots. BHC and chlordan gave considerable protection against *Diabrotica* until the plants were safe from attack, but DDT and tung-nut hull meal gave little if any. A large proportion of the seed in the soil was destroyed by *Hylemyia* ; the percentages of plants damaged by it were 20, 30 and 50 for chlordan, BHC and DDT, and 58, 85 and 93 for tung-nut hull meal, no treatment and fertiliser alone. The injury in individual plants was usually less severe in the DDT plots than in untreated ones, however, and this treatment gave yields equal to those from BHC and chlordan. This indicated that a fairly heavy infestation of *Diabrotica* does not materially influence yield unless the stand is reduced below the minimum necessary for maximum production. The authors consider that the main damage to maize by *Diabrotica* is the reduction in number of seedlings, which would necessitate replanting after severe infestations.

The yields of the plots in bushels per acre were 49 for no treatment, 53 for tung-nut hull meal, 58 for fertiliser alone and 75–77 for the three insecticides. Nitrogen was applied as a side dressing to all plots. In nutritional tests made after the larvae had left the soil, chlordan, BHC and DDT showed no value as plant nutrients, and none of them visibly affected germination or produced any abnormal condition of the plants, except that when the plants were about 18 inches high, some of those in the BHC plot showed severe symptoms of phosphate deficiency ; soil analysis showed that soluble phosphorus was abundant in the soil, but plant-tissue analysis indicated the scarcity of phosphorus in the affected plants. In greenhouse tests, dosages of BHC as low as 4 oz. γ isomer per acre distorted and killed maize seedlings.

JOHANSEN (C.) & BREAKEY (E. P.). **Control of the Orange Tortrix on red Raspberries.**—*J. econ. Ent.* **42** no. 6 pp. 911–914, 2 refs. Menasha, Wis., 1949.

Three tests on the control of *Tortrix* (*Argyrotaenia*) *citrana*, Fern., on red raspberries in the Puyallup Valley of Washington [*cf. R.A.E.*, A **38** 25] were carried out in 1948. All quantities of spray ingredients are given per 100 U.S. gals. water, and all sprays were applied at 200 U.S. gals. per acre. Dusts were applied at 30 lb. per acre in the first test and at varying rates in the third.

In the first test, four applications were made between 16th April and 2nd June and the results were assessed by the numbers of living larvae per 40 hills found on eight dates from 22nd April to 16th August on the plants receiving the various treatments. The total numbers and (in brackets) the numbers on 16th August were 19 (11) for a spray of 2 lb. 90 per cent. cryolite and 1 U.S. quart summer-oil emulsion, 12 (7) for a dust containing 50 per cent. cryolite, 10 per cent. attapulgite and 3 per cent. methylated naphthalenes, 15 (11) for a spray of 2 lb. 50 per cent. wettable methoxy-DDT (methoxychlor) powder, 11 (9) for a spray of 0·3 lb. 25 per cent. wettable parathion powder, 2 (1) for a spray of 2 lb. 50 per cent. wettable DDD (dichlordiphenyldichlorethane), and 2 (1) for a dust containing 5 per cent. DDD, 10 per cent. attapulgite and 3 per cent. methylated naphthalenes. DDD thus had a better residual effect than any other material. In the second test, in which sprays were applied four times between 20th April and 11th June, the total numbers of living larvae per 40 hills on eight dates from 1st May to 16th August were 17 for 2 lb. cryolite, 3 for 2 lb. 50 per cent. DDD, 20 for 2 lb. 50 per cent. methyl-DDT (ditolyltrichlorethane), and 20 for 0·3 lb. 25 per cent. wettable parathion powder. DDD again had the best residual effect. Larvae were not counted on plots treated with sprays of chlordan and tetraethyl pyrophosphate because the former was phytotoxic and the latter gave poor results. In the third test, in which dusts were applied on 30th April, 21st May and 3rd June, the use of a number of synthetic and natural cryolite dusts varying in strength and diluents did not cause much variation in results. DDD was significantly better than cryolite, and 5 per cent. methoxy-DDT had very poor residual effect, though applications of this material during the picking season reduced the infestation at that time.

The use of DDD or methyl-DDT at excessive strengths in a spray or dust or in a spray with an oil adhesive damaged the leaves, but they were safe when used at a maximum of 2 lb. powder per 100 U.S. gals. without the oil. A liquid chlordan formulation caused a general yellowing of foliage, apparently because of the emulsifying agent. The liquid formulations with the highest chlordan content were the safest, and a wettable spray powder also appeared to be safe.

The late wet season in western Washington in 1948 undoubtedly kept *T. citrana* in check. The first actively feeding larvae, pupae and adults were observed in late March, the middle of April and the middle of May, respectively. Parasites were occasionally found in the middle of April, and there was 50 per cent. parasitism in some fields by the last week in July. Parasites gave partial control in some fields during the picking season. They included *Phytodietus vulgaris*, Cress., *Ischnus atriceps*, Cress., *Angitia* (*Horogenes*) *eureka*, Ashm., *Campoletis* sp., *Oncophanes atriceps*, Ashm., and *Apanteles aristoteliae*, Vier., but the most important was a new species of *Meteorus*, which was described by Johansen (*Ann. ent. Soc. Amer.* **42** p. 319, 1949) as *M. argyrotaeniae*. Chrysopid and Coccinellid larvae and spiders were observed feeding on *Tortrix* larvae. A list is given of 22 plants from which the larvae were collected and reared. Larvae collected on lemon foliage at Whittier, California, were reared out of doors on caged raspberry plants.

It is concluded that all the materials tested except tetraethyl pyrophosphate gave some control of the Tortricid, and that DDD gave the most consistently good results and the best residual action.

Madsen (H. F.) & Borden (A. D.). **The Eye-spotted Bud Moth on Prune in California.**—*J. econ. Ent.* **42** no. 6 pp. 915–920, 2 figs., 10 refs. Menasha, Wis., 1949.

The following is based on the authors' summary and conclusions. *Spilonota ocellana*, Schiff., is an important pest of prunes in the Santa Clara Valley and

the prune-growing counties of the coastal area of California. The larvae overwinter in hibernacula at the base of fruit spurs on second-year wood, and emerge as the buds open and feed on the buds and blossoms, which they tie together with silk. Later, they tie unfolding leaves together and feed on them from within the shelter, but none of this injury is important. They return to the twigs to pupate in shelters of dry leaves, bud scales or blossom parts in May, and the moths are present in May and June. Flight begins when the light intensity drops to 100 foot-candles or less and continues all night if the temperature remains above 50°F. Mating and oviposition take place at night. The eggs are deposited singly on both leaf surfaces and hatch in 8–14 days. The larvae feed on the lower leaf surfaces and construct tunnels of frass lined with silk at first and later tie leaves to fruit and feed on the fruit surface from under this protection. The resulting shallow feeding holes and the cementing of the leaf to the fruit by the gum that is produced accounts for the injury to the prune crop. In September and October, the larvae desert the leaves and construct their hibernacula.

Parasitism of *S. ocellana* is very low in California ; the parasites collected in 1948 were *Meteorus ictericus*, Nees, *Apanteles aristoteliae*, Vier., *Brachymeria ovata*, Say, and a species of *Exochus*, and all emerged from larvae that were about to pupate. The predatory mite, *Pediculoides ventricosus*, Newp., destroyed up to 50 per cent. of the larvae within their hibernacula during the mild winter of 1947–48, but it gave no control in 1948–49. Experiments with various sprays carried out in 1947–49 showed that parathion at a concentration of 1 lb. 15 per cent. wettable powder or 12 oz. 25 per cent. wettable powder and DDD (dichlordiphenyldichlorethane) at 2 lb. 50 per cent. wettable powder per 100 U.S. gals. gave excellent control. Parathion is to be preferred, as it destroys the Tetranychid mites that may become a problem in the late season and is also effective against the mealy plum aphis [*Hyalopterus arundinis*, F.], which is an important pest in the Santa Clara Valley. The most logical time to spray is during the summer months, when 70 per cent. or more of the larvae of the new generation have hatched. Where the tussock moth [? *Hemerocampa vetusta*, Boisd.], the fruit-tree leaf-roller [*Tortrix argyrospila*, Wlk.] and thrips are also problems, it is necessary to spray in the jacket period (late April) to control these, and in such cases a mid-June spray should be applied to prevent reinfestation by moths from adjoining unsprayed prunes or cherries. It was shown that parathion dusts were less effective than sprays.

Wilcox (J.), Howland (A. F.) & Campbell (R. E.). **Insecticides for the Control of Thrips on Onions grown for Seed in southern California.**—*J. econ. Ent.* **42** no. 6 pp. 920–927, 2 graphs, 5 refs. Menasha, Wis., 1949.

The results are given of experiments on the control of thrips on onions grown for seed in the Coachella and Yucaipa Valleys of California in 1945 and in the Yucaipa Valley in 1947. *Thrips tabaci*, L., was the principal species damaging the plants before they headed, and this species and *Frankliniella moultoni*, Hood (*californica*, Moult.) damaged the seed heads. Dusts containing 10 per cent. DDT in pyrophyllite alone or with 25 per cent. sulphur were applied at 30 lb. per acre with hand dusters in 1945 and with power dusters in 1947. The sprays were applied with a power sprayer ; all except the spray of tartar emetic and sugar and those prepared from commercial wettable powders contained 12 oz. phthalic glyceryl alkyl resin per 100 U.S. gals. All spray quantities are per 100 U.S. gals.

In 1945, sprays were applied at about 175 U.S. gals. per acre on 16th and 30th April, during the pre-heading stage, and at 130–150 U.S. gals. per acre on 26th May, 5th, 12th, 19th and 25th June and 2nd July, during heading.

They contained 1 lb. DDT as an emulsified toluene solution, 1 or 1·5 lb. DDT as a dust fused with sulphur, or 4 lb. tartar emetic or 1 U.S. quart nicotine sulphate, both with 4 lb. sugar. In the pre-heading treatments, DDT was more effective than nicotine or tartar emetic against both nymphs and adults, with no difference between DDT sprays. Nicotine was superior to tartar emetic against the nymphs and tartar emetic to nicotine against the adults. During the heading period, DDT was superior to tartar emetic and tartar emetic to nicotine. Spraying increased the yield by 405–545 lb. viable seed per acre, with no significant difference between treatments. In another test, DDT dust applied at intervals of 1–2 weeks from 27th February to 4th April had no effect on plant growth or seed yield, because of low thrips populations.

In 1947, when both temperature and rainfall were more favourable for thrips development, DDT dust applied during the pre-heading season caused marked improvement in plant growth and seed yield. Brown Spanish onions were less susceptible to thrips injury during the pre-heading period than Early Texas Grano, Yellow Bermuda or White Grano varieties. When treatments were not begun until the heading period, sprays containing 1 lb. DDT as a dust of 10 per cent. DDT fused in sulphur or as a 20 per cent. wettable powder or 0·5 lb. as the fused dust, applied on 29th May, 4th, 12th, 18th and 25th June and 2nd July, increased the amount of viable seed by 101–174 lb. per acre, but showed no significant difference between treatments, though 1 lb. DDT was usually superior to 0·5 lb. in thrips control. Applications of DDT dust to the seed heads when they were opening and after they had opened, over a six-week period in 1945 and a nine-week period in 1947, gave the best results when made weekly.

Most of the tests showed that DDT dusts and sprays are effective in controlling thrips on seed onions and give decided benefits in seed production. The cost of the applications necessary to obtain the best results is not prohibitive in view of the benefits obtained in seed yield.

Brannon (L. W.). **Tests of some new Insecticides to control Mexican Bean Beetle.**—*J. econ. Ent.* **42** no. 6 pp. 928–930, 5 refs. Menasha, Wis., 1949.

The results are given of tests of dusts for the control of *Epilachna varivestis*, Muls., on snap beans at Norfolk, Virginia, in 1947. Applications were begun when the plants had small first or second trifoliate leaves in the first two tests and when they were budding or beginning to bloom in the others and finished when they were beginning to set small pods. In the first test, in which dusts were applied with a power duster equipped with a light cloth trailer 12 ft. long on 21st and 27th May and 10th June, a mixture containing 0·45 per cent. rotenone, 3 per cent. DDT and 50 per cent. sulphur gave 98 per cent. control of the larvae, and 5 per cent. toxaphene, 3 per cent. hexaethyl tetraphosphate and 5 per cent. chlordan gave 85, 70 and 42 per cent. In the second, applications were made with a hand duster to both sides of the rows on 15th, 21st and 28th July, so that the undersurfaces of the leaves were covered, and a mixture containing pyrethrum (0·08 per cent. pyrethrins) with 0·5 per cent. piperonyl cyclonene and 25 per cent. sulphur gave 90 per cent. control, and 0·5 per cent. parathion and 10 per cent. toxaphene with 25 per cent. sulphur gave 85 and 75 per cent. In the third, applications were made with the power duster on 27th August and 3rd and 10th September, and the dusts contained 3 per cent. DDT or methoxy-DDT (methoxychlor) and 50 per cent. sulphur, with and without 0·5 per cent. piperonyl cyclonene. Methoxy-DDT and DDT gave 76 and 56 per cent. control without piperonyl cyclonene and 78 and 35 per cent. with it. In the fourth test, in which applications were made on 30th September and 6th October and all dusts contained 50 per cent. sulphur, the

control percentages were 79 for a mixture containing 0·5 per cent. rotenone and 3 per cent. DDT, and 18 and 13 for 10 per cent. sabadilla, with and without 0·5 per cent. piperonyl cyclonene.

It is concluded that rotenone mixed with DDT and sulphur is more effective than chlordan or freshly mixed hexaethyl tetraphosphate, and that commercial 0·5 per cent. parathion dust is almost as effective as a mixture containing 0·08 per cent. pyrethrins and 0·5 per cent. piperonyl cyclonene and more effective than 10 per cent. toxaphene. Piperonyl cyclonene did not improve control when mixed with dusts containing DDT, sabadilla or methoxy-DDT.

BUTLER jr. (G. D.) & CARRUTH (L. A.). **Corn Earworm Control with insecticidal Dusts on western Long Island, 1949.**—*J. econ. Ent.* **42** no. 6 pp. 930–933, 1 ref. Menasha, Wis., 1949.

In field tests on the control of *Heliothis armigera*, Hb., on sweet maize with DDT and other organic compounds, carried out on western Long Island in 1949 [*cf. R.A.E.*, A **38** 237], the dusts were applied to two varieties with knapsack and rotary hand dusters five times at intervals of 2–7 days in August. In general, the two types of dusters produced comparable control. There was little difference between mechanically mixed dusts containing 5 and 10 per cent. DDT, and comparable control was obtained with impregnated dusts containing 1·5 per cent. DDT, but 5 per cent. DDD (dichlordiphenyldichlorethane) and 1 per cent. parathion gave less control. When the dusts were applied to three varieties with a six-row, self-propelled, high-clearance duster, drawn at 3–4 miles per hour, five times at intervals of 2–7 days in August, uniformly satisfactory results were obtained with a 5 per cent. DDT dust, and there was no apparent advantage from the use of 10 per cent. DDT, but there was considerable difference between three impregnated dusts containing 1·5 per cent. DDT, possibly owing to unavoidable differences in rate of application. Parathion and DDD gave definite control, but neither was as effective as 5 per cent. DDT. When 5 per cent. DDT dust was applied with the three types of equipment 3–6 times at intervals of two or three days, beginning when the first silks in a planting appeared, differences in equipment, number of applications or intervals between applications had no appreciable effect on results.

It appears that adequate control of *H. armigera* can be obtained with either hand or commercial equipment now available, and that three properly made applications should be sufficient. It is apparently necessary to keep the silks adequately covered with dust during the period of oviposition and hatching, and the proper timing of applications on a given planting will probably vary according to the variety, seasonal conditions and other local factors. Unsatisfactory results with self-propelled six-row dusting outfits proved to be due to excessive operating speeds.

ANDERSON (L. D.) & HASHE (J. W.). **Control of Corn Earworm on Sweet Corn in southern California.**—*J. econ. Ent.* **42** no. 6 pp. 933–941, 5 refs. Menasha, Wis., 1949.

The following is mainly based on the authors' summary. During 1948, twelve experiments were carried out with 115 insecticide treatments applied to the ears of sweet maize in the Coachella, Chino and Riverside areas of southern California for the control of *Heliothis armigera*, Hb. DDT, DDD (dichlordiphenyldichlorethane), toxaphene, fluoro-DDT (difluorodiphenyltrichlorethane), chlordan, methoxy-DDT (methoxychlor), methyl-DDT (ditolyltrichlorethane), pyrethrum, styrene dibromide, parathion and mineral oils were applied as dusts, with hand machines and power dusters, as sprays with

hand sprayers, as aerosols with a new high-pressure knapsack aerosol machine [*cf. R.A.E.*, A **37** 474], and as solutions injected with an oil-can. DDT, DDD and parathion were the only insecticides used in dusts, but all were applied by the other methods except styrene dibromide, which was used for injection only, and parathion, which was not used for injection or aerosol treatment.

It was found that 1 per cent. DDT and 1 per cent. DDD in mineral oil gave the best control and that they were most effective when injected or applied as aerosols. All the insecticides applied by these methods gave significant control. Dusts were ineffective, but the poor control was probably due to the inadequate number of applications. Sprays gave some control, water emulsions being inferior to oil solutions and parathion being ineffective. When the aerosols were applied with varying distances between the nozzle and the tip of the ear, two inches was found to be the most effective. Injection was slightly more effective than application in aerosols, but the latter was 4–5 times as rapid. The amount of material used by the aerosol method was 6–10 U.S. gals. per acre. Applications of aerosols and injections should not be made until after the maize is pollinated.

In these tests, no DDT residues were found on the edible portion of the ear, but 3–137 parts per million were found on the husk, silk or tip of the ear.

Lange jr. (W. H.), Carlson (E. C.) & Leach (L. D.). **Seed Treatments for Wireworm Control with particular Reference to the Use of Lindane.**—*J. econ. Ent.* **42** no. 6 pp. 942–955, 1 fig., 13 refs. Menasha, Wis., 1949.

Soil treatment with certain chemicals has given effective control of wireworms, but may affect the plants or result in accumulations of the chemicals in the soil. Seed treatment cannot supplant soil treatment if control is based on reduction in total wireworm populations, but it has proved an effective and practical measure under Californian conditions when the wireworms were attracted to the seeds in sufficient numbers during germination and the seeds were not injured by an effective dose of insecticides. The efficacy of seed treatments depends on the species of wireworms involved, their activity at the time of sowing, the proportion of the population attracted to the seed, the type of seed and the time of planting. Laboratory tests with BHC (benzene hexachloride) against four species of wireworms showed that *Aeolus* sp. was the most susceptible and *Limonius canus*, Lec., *L. californicus*, Mannh., and *Anchastus* sp. progressively less so, and field observations showed that *L. clypeatus*, Mots., and *Melanotus oregonensis*, Lec., were readily affected. Usually only 50–70 per cent. of the population of larger wireworms are attracted to the seed at the time of germination, and 70–95 per cent. of these are killed, but control of this proportion allows a stand to become established. Wireworms moving towards the surface later may feed on the small plants of some crops, such as sugar-beet and lima bean, without seriously reducing the stands, but some damage to young seedlings of certain cold-weather crops, including spinach and sugar-beet, that can be planted in the autumn or winter when wireworms are not active may occur when the wireworms move to the surface again in spring, as by this time the amount of insecticide on the seed coats in the soil is very much reduced.

In 1946, greenhouse tests showed that technical BHC (10–12 per cent. γ isomer) was very toxic to wireworms when applied to seeds, and in 1947, treatment of sugar-beet seeds with 1–2 per cent. technical BHC powder gave effective field control. This dosage did not appear to damage sugar-beet, but caused serious injury to other crops. In 1948, the discovery that lindane (99·95 per cent. γ BHC) was less injurious to seeds than technical BHC made

it possible to extend seed treatment. It was shown that there was no significant difference in toxicity to wireworms between 99·95 and 100 per cent. γ BHC. Experiments were begun to determine the minimum amount of γ BHC that would give adequate protection and the maximum amount that different seeds would tolerate, and tests were also made of the compatibility of insecticides and fungicides on seeds. Insecticides and fungicides were applied as dusts in open rotating mixers, this treatment being sometimes followed by light spraying with water ; as suspensions of wettable powders or solutions with a sprayer ; or as liquid suspensions with a slurry seed treater. The dosages given are per 100 lb. seed, and formulations containing 25, 50 and 75 per cent. γ BHC as lindane are referred to below as L25, L50 and L75, respectively.

In laboratory and greenhouse studies on the tolerance of different seeds, sugar-beet was tolerant to 8 oz. technical BHC or 1 lb. L25, in either wet or dry treatments. Storing seed treated with 1–2 lb. L25 for 15 months in jars with loosely fitting lids resulted in 2–3 days delay and 40 per cent. reduction in plant emergence. There was evidence that BHC had some fungicidal effect on *Phoma betae*, but none on *Pythium ultimum*. The emergence of baby varieties of lima beans in sterile soil was reduced by seed treatment with 1 lb. technical BHC but not with 1 lb. DDT or Spergon. In most tests with technical BHC, it was necessary to reduce the dosage to 2 oz. to escape reduction and delay of plant emergence, stunting and decreased seedling weights, but 4 oz. L25 in wet or dry treatments caused only occasional reduction and delay in germination. The fact that only a small amount of moisture is applied to seed by the slurry treatment led to the development of L75. When this was applied to lima beans of two large varieties at dosages of 0·66 and 1·33 oz., the smaller dose caused significant delay in germination of one variety and the bigger one an additional delay and reduced plant emergence, and there was evidence that lindane directly affected either the growth of the plants or the absorption of the cotyledons. On the other variety, the smaller dose had no significant effect, but the other reduced seedling weight and caused a temporary delay in germination. The addition of a small quantity of a commercial adhesive to lindane and fungicide applied to large lima beans was useful. The tolerance of pink beans and red kidney beans to technical BHC was similar to that of baby lima beans. Tendergreen beans showed a slight delay in emergence and Stringless beans delay in emergence and decreased seedling weight after slurry treatment with 1·33 oz. L75. Technical BHC had no effect on maize, cucumber or lettuce seeds at 1 lb. or on peas at 8 oz. ; milo sorghum and cotton were safely treated with 4 and 5·33 oz. L75, respectively, tomato with 1 lb. L50, and okra [*Hibiscus esculentus*] and barley with 8 and 4 oz. L25. Cantaloupe melon was fairly tolerant to technical BHC, DDT and Semesan, and BHC was combined with several other fungicides on various seeds with no ill effects. In limited tests with other insecticides, chlordan delayed the germination of sugar-beet when used at 1–2 lb. 47 per cent. emulsifiable mixture with an oil base, but not at 2 lb. 50 per cent. wettable powder. When applied to large lima beans in slurry treatments, 2 oz. 40 per cent. wettable chlordan powder had no effect, but 2 oz. 25 per cent. aldrin [1, 2, 3, 4, 10, 10-hexachlor-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4, 5, 8-diendomethanonaphthalene] or dieldrin [1, 2, 3, 4, 10, 10-hexachlor-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4, 5, 8-diendomethanonaphthalene] as wettable powders caused a slight delay in emergence and a reduction in seedling weight.

In laboratory tests, all wireworms confined in soil in small containers with seed of baby lima beans treated with 4 oz. L25 became sluggish or died within two weeks. The lindane apparently killed the larvae largely by contact action, but also acted as a stomach poison and a fumigant. Tests of 50 per cent. wettable powders of the different isomers of BHC, applied to lima-bean seed

in sprays, showed that the γ isomer was the most toxic to wireworms ; technically pure α, β and δ isomers exhibited little or no toxicity, though 0·2 oz. β BHC had a slight effect after four weeks. Detailed laboratory studies with lima-bean, okra, tomato and sugar-beet seeds showed that larvae of *L. canus* affected by BHC rarely recovered, though they might live for several weeks ; complete mortality on the first three was obtained with 2 and 4 oz. L25 and 8 oz. L50 with 1·5 lb. cuprous oxide, respectively, and 83 per cent. on sugar-beet with 2 lb. L25. The higher dose necessary on tomato may have been due to the fact that the larvae did not feed readily on it and that on sugar-beet to the uneven seed surface and greater absorption of the chemical. Similar results were obtained with *L. californicus* on baby lima beans and cucumber, with some indication on lima beans that a wet application was superior to a dry one. In slurry treatments, 0·33 lb. L75 gave mortality of *L. canus* on sugar-beet comparable with that from 1 lb. L25. Storage of seed treated with the latter for ten months in jars with loosely fitting lids resulted in 50 per cent. lessening of insecticidal efficiency. On lima bean, 2 oz. 50 per cent. wettable aldrin and dieldrin powders were both toxic to wireworms, but on sugar-beet, 1 lb. 25 per cent. wettable parathion and 2 lb. 40 per cent. wettable chlordan gave low mortalities.

In the field, the proportion of wireworms killed in the plant rows within 6 ins. of the surface generally increased directly with the dosage of BHC. When sugar-beet seed was treated, mortality of *L. canus* ranged from 50 per cent. with 4 oz. L25 to 93 per cent. with 1 lb. In the same test, 1 and 2 lb. 15 per cent. wettable parathion powder gave 85 and 88 per cent. kill, but 1 lb. 50 per cent. chlordan powder gave less than 4 per cent., and the number of plants per foot of row showed the superiority of lindane to either. On baby lima beans, technical BHC was more toxic than equivalent doses of lindane at low concentrations, 2 oz. technical BHC being comparable with 1 lb. L25, but higher doses of the technical compound apparently repelled the wireworms and had less insecticidal effect. Treatment had no adverse effects on the seeds in this test, but when similarly treated seeds were subjected to higher air and soil temperatures during the germinating period, 8 oz. and 1 lb. L25 or 1 lb. 15 per cent. parathion caused serious damage. There was no indication that storage for three months increased the effect of treatment with 4 oz. L25 on germination or seedling weight.

Combined insecticidal and fungicidal treatment of large quantities of milo-sorghum seed with 1·33 oz. L75 and 2 oz. Phygon XL increased the stand of seedlings from 2·12 to 9·44 per foot of row. The increase was due primarily to wireworm control, but other important factors were the control of *Pythium* seed decay and the reduction of seed-borne *Fusarium moniliforme*, though the treatment had little effect on soil-borne *F. moniliforme*. In a test on the effect of seed treatment on the total wireworm population, sugar-beet seed was treated with 1 lb. L25 and planted on 15th February, and soil samples were taken at depths of 0–7, 7–13 and 13–19 inches on 18th April. The numbers of wireworms not passing through a 16-mesh sieve per sample of treated and untreated soil were 1·33 and 2·5 in the top layer and 0·66 and 1·17 in the second ; there was none in the lowest. This indicates a reduction of 45 per cent. in the total population.

These experiments indicate that lindane is the most promising of the compounds tested as regards tolerance, safety and insecticidal effect. The treatment is economical and minimises the possible adverse effects of accumulating large amounts of chlorinated compounds in the soil ; it is regarded as a method of obtaining temporary control and a good stand of plants, and has to be repeated for each crop. On the bases of seed tolerance and insecticidal effect, it is suggested that the doses of L25 per 100 lb. seed

should be 1 lb. for sugar-beet, 8 oz. for cotton, lettuce and tomato, 4 oz. for cucumber, cantaloupe, maize, pea, okra, barley and milo sorghum, 2–4 oz. for baby lima beans and most other beans and 1–2 oz. for large lima beans and wheat. Of the different methods of applying lindane, treatment with liquid suspensions or solutions was found most adaptable because of the greater adherence and evenness of distribution of the chemical on the seed, safety to the operator and insecticidal efficiency.

GAINES (J. C.) & DEAN (H. A.). **Comparison of Sprays and Dusts for Grasshopper Control.**—*J. econ. Ent.* **42** no. 6 pp. 956–959, 1 graph, 2 refs. Menasha, Wis., 1949.

In 1949, dusts of toxaphene, chlordan and BHC (benzene hexachloride) and sprays of toxaphene gave excellent control of grasshoppers in commercially treated fields in Texas [*cf. R.A.E.*, A **38** 65]. Sprays gave good results in windy weather, when dusts could not be applied effectively ; both were applied with ground machines and from aeroplanes. In the same year, laboratory tests were carried out to compare the effectiveness of several insecticides applied as sprays and dusts against *Melanoplus differentialis*, Thos., and field tests were made on mixed grasshopper populations, mainly *M. differentialis*.

In laboratory tests, in which field-collected nymphs were sprayed with miscible oil concentrates of toxaphene, chlordan, parathion, BHC (all isomers) and lindane [at least 99 per cent. γ BHC], applied as emulsion sprays at 10 U.S. gals. per acre, and removed to clean cages after 20 seconds, the median lethal dosages were 1·17, 0·49, 0·05, 0·04 and 0·08 lb. active ingredient per acre, respectively, the mixed BHC isomers being thus twice as toxic as lindane. When applied to adults as sprays prepared from wettable powders and miscible oil concentrates, respectively, BHC applied at 0·08, 0·17 and 0·25 lb. per acre caused 14·7, 19 and 38·7, and 17·7, 29 and 22·7 per cent. mortality, and parathion at the same rates caused 17·6, 20·5 and 30·3, and 14·1, 36·2 and 35·5 per cent. At concentrations ten times as great, chlordan caused 7·4, 38·2 and 100, and 7·8, 43 and 53·4 per cent. mortality, and toxaphene 11·1, 14·7 and 32·3, and 10·1, 24·6 and 62 per cent. Higher dosages were required to kill adults than nymphs.

In a field test of spray emulsions against nymphs in the first and second instars, chlordan at 0·56 lb. per acre, toxaphene at 0·49 lb., aldrin [1, 2, 3, 4, 10, 10-hexachlor-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4, 5, 8-diendomethanonaphthalene] at 0·12 lb., dieldrin [1, 2, 3, 4, 10, 10-hexachlor-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4, 5, 8-diendomethanonaphthalene] at 0·1 lb., parathion at 0·1 lb. and BHC at 0·15 lb. all gave more than 90 per cent. control after 14 days. A further test showed that chlordan and toxaphene were about twice as toxic in spray emulsions as in dusts, and that parathion, BHC, aldrin and dieldrin were also more effective in spray emulsions than in dusts. Parathion and dieldrin were more toxic than the other compounds, the latter showing better residual toxicity and giving complete control of young hoppers for 14 days when applied at 0·1 lb. per acre.

HUNT (R. W.). **The Common Dry-wood Termite as a Pest.**—*J. econ. Ent.* **42** no. 6 pp. 959–962, 1 ref. Menasha, Wis., 1949.

Kalotermes minor, Hag., occurs as far north as Tacoma, Washington, but its primary range is from Mendocino County, California, to the southern tip of Lower California. In northern and central California it is active in a narrow coastal strip, but in southern California it extends to the Colorado River, where it overlaps the westerly range of *K. hubbardi*, Banks, and at the southern

end of its range it extends into the territory of *K. marginipennis*, Latr., which inhabits the higher regions of Mexico. It is becoming increasingly important in southern California, being concerned in 3 per cent. of the cases of termite damage to buildings reported in Los Angeles County in 1929–31 and in 75 per cent. in one area (the only one for which figures are available) in 1948. The author briefly describes the nymph, soldier and alate of the termite, indicates factors that may have contributed to its increase and discusses control measures.

K. minor is an inhabitant of dry sound wood, and all the individuals in a colony except the mature reproductive forms and the soldiers are nymphs. Except when already infested timber is built into it, infestation of a structure is due solely to alates that fly to it. Typical points of entry are through joints between rafters and sheathing or junctures between rafters and ridge or studding and plates, through mortises in window sashes and cracks between sashes and frames, under casings or through cracks in knots. Swarming occurs at mid-day when the weather is warm and clear, chiefly late in September or in October in most districts, though sometimes from June until December. Newly established colonies can be located by the frass, composed of fine particles of the wood, that is deposited at the point of entry. When the male and queen have made a cell of sufficient size, they enter it, plug the entrance hole and become inactive for periods of up to nine months, but there may be 20 nymphs and one soldier by the end of the first year, 40 nymphs and one soldier by the end of the second and about 160 nymphs and 5–6 soldiers at the end of the third ; alates are seldom seen until the fourth year. This termite is a general feeder, but seems to prefer the sappy or spring-growth wood. It attacks various fruit and shade trees and shrubs, and piles of new timber and new houses, in the framing stage, seem to be especially attractive to it. Heavy infestations may cause considerable structural weakness in timbering, but collapse of buildings is uncommon except with the help of powerful external forces. In an infested house, furniture, floors, doors and rugs may be damaged.

Some of the factors that may account for the present noticeable increase in infestation by dry-wood termites are the closer proximity of houses due to recent building, the extensive practice of subdividing orchards into housing plots, leaving a few trees that may serve as foci of infestation, inadequate protection of piled timber during the flight season, the use of the poorer grades of timber due to the general shortage of building materials, and the presence of numbers of heavily infested utility poles throughout the older residential districts.

The insertion of paris-green dust into holes drilled in infested timbers is the usual method of control. The injection of volatile liquid fumigants has been successful but has not been shown to be more effective or less expensive than the use of powder. The removal of all infested wood is desirable if convenient. Fumigation with 2·5–3 lb. hydrocyanic acid gas or methyl bromide per 1,000 cu. ft. space for 18–48 hours has recently given good results. The entire structure is encased in a gas-tight membrane consisting of three-ply gas-tight kraft paper or rubberised tarpaulins ; in frame-stucco construction, the covering is limited to all exterior wood surfaces. This method has the advantage that the gas can be made to penetrate to otherwise inaccessible spaces, controls other pests and does not entail extra expense for structural repairs, but it has no residual effect to reduce the probability of reinfestation. Removal of neighbouring sources of infestation is advocated.

Many authorities consider the prevention of infestation by dry-wood termites to be practically impossible. Sealing all external timber openings would be difficult and expensive, and building the structure from pressure-treated wood, which might give permanent protection, might also result in

persistent odours from the chemicals, but it is possible that some of the new synthetic organic insecticides with residual action may prevent infestation [*cf. R.A.E.*, A **38** 199–200].

PLANK (H. K.) & FERRER-DELGADO (R.). **Permanence of DDT in Powder-post Beetle Control in Bamboo.**—*J. econ. Ent.* **42** no. 6 pp. 963–965, 3 refs. Menasha, Wis., 1949.

As preliminary investigations in Porto Rico had shown that DDT gave outstanding protection of harvested bamboo against *Dinoderus minutus*, F., a single brushed application of a 5 per cent. solution in kerosene keeping 94 per cent. of the internodes of highly susceptible culms free from infestation for ten weeks, further tests were made of its lasting qualities against this insect. DDT was used at 5 per cent. in diesel fuel oil and in addition to freshly harvested one-year-old culms of *Bambusa vulgaris*, similar culms that had been clump-cured for 35 days were treated to test the effect of previous drying on control. Sections of ten internodes, 8–14 ft. long and 2–3·75 inches in outside diameter and with moisture contents of 71·9 per cent. when freshly harvested and 48·1 per cent. when cured, were used. They were immersed for ten minutes in the solution or in diesel oil alone and allowed to dry on a horizontal rack sheltered from the weather. Loss of the wet appearance of the pieces treated with DDT required about 4·5 and 3 hours for green and cured sections. Examination every three months for a year showed that the solvent alone gave a little protection, which was significant during the first six months after application to clump-cured material, whereas DDT gave highly significant protection of both freshly harvested and cured material for 12 months. The effect tended to be more permanent on the former, but the difference in external evidence of internodal infestation was never statistically significant. When split open at the end of the year, all the 300 internodes of untreated freshly harvested culms were severely damaged and all but five of the 300 internodes of untreated cured ones were lightly damaged. The percentage reduction in infestation given by DDT was 91 in freshly harvested culms and 79 in cured ones ; 27 and 68 internodes (out of 300) were damaged, the difference being statistically significant. Most of the damage, particularly in the cured culms, was caused by the longitudinal scoring of the inner surfaces by the beetles, some of which entered through cracks that developed in the rind, but most of such pieces would still be considered serviceable. Apparently no additional improvement is to be derived from previously drying the culms, as in clump-curing, before dipping in DDT. The DDT solution left no stain and did not appear to affect the quality of the wood. The residue was visible on most of the culms three months after treatment, and on some for nine months more. It was particularly persistent on the sections that had been dipped green, and this ability to retain residue was an important factor in the protection of the freshly harvested culms ; apparently, as suggested by the shorter drying time, the partly dry surface of the cured culms absorbed more of the solution and consequently left a smaller residue on the outside. Ring samples, which became thoroughly saturated with the solution, remained uninfested for 24 months, although continuously exposed in a room containing numerous beetles. Cage tests showed that, after this period, the residue was still toxic enough to kill all beetles exposed to it for four days or more. It is evident, therefore, that much of the internal damage in dipped culms could have been prevented by splitting them so that the DDT could reach all the surfaces, or breaking out the partitions at the nodes. Small samples of commercial bamboo handled in both ways and retreated after shaping for use were still free of infestation by any wood-boring insects after nearly 30 months.

Hoskins (W. M.). **Deposit and Residue of recent Insecticides resulting from various Control Practices in California.**—*J. econ. Ent.* **42** no. 6 pp. 966–973, 8 refs. Menasha, Wis., 1949.

This paper on the danger of the contamination of foodstuffs of vegetable and animal origin with insecticidal chemicals is based on the results of numerous practical experiments in California. The residues in parts per million on various fruits and vegetables treated with DDT, DDD (dichlordiphenyldichlorethane), methoxy-DDT (methoxychlor) or parathion are shown in tables, with the methods and dates of application, number of treatments, quantity of active ingredient used in each, and, since loss of deposit by weathering, volatilisation and other processes is strongly affected by time, the interval between the last application and analysis. The DDT residue was well below 7 p.p.m. [*cf. R.A.E.*, A **35** 110] one month after application in all cases and below 5 p.p.m. in most, dusts giving much lower deposits than sprays, and similar results were obtained in limited observations on DDD and methoxy-DDT. More than 7 p.p.m. DDT or DDD sometimes occurred on dried apricots, but not on prunes, on which the lye treatment probably destroys the compounds, and olives showed comparatively large DDT residues even after processing. Parathion disappeared rapidly, and all dried or processed fruits were free from it except for an indication of a minute amount in one prune sample. Residues exceeding 1 p.p.m. after a few days were found only on grapes and olives, and they rapidly decreased thereafter. The residues from this material can be measured only in fractions of a part per million from any practical spray programme. Apricots sprayed with basic lead arsenate showed 5·4 p.p.m. arsenic trioxide 81 days after application, which would result in heavy contamination of the dried fruit. The arsenical residue on prunes was reduced from 1·2 to 0·3 p.p.m. by the drying process. Two or three applications of 2–6 lb. chlordan per 100 U.S. gals. spray against the codling moth [*Cydia pomonella*, L.] resulted in residues of 8–16 p.p.m. on pears a month later; chlordan seems to be deposited more heavily than DDT and to be fairly persistent.

The contamination of raisins stored for a month in boxes that had been treated with DDT on the outside indicated that this compound could spread by volatilising. In a more precise experiment, raisins stored for a month over powdered DDT, but separated from it by at least one inch, in closed or open jars showed 1·67 and 2·55 p.p.m. DDT, respectively. The slight air movement due to changes in temperature from day to night would account for the greater contamination in the open jar. The volatility of DDT was also proved by analysing grain from elevators that had been treated when empty. Barley from the middle of a 72,000 bushel elevator that had been sprayed with 225 U.S. gals. 0·5 per cent. suspension of DDT contained 1·5 p.p.m., and wheat from the middle of a 42,000 bushel elevator treated with the same amount of suspension contained 2·4 p.p.m. The grain had been in storage for 3–4 months.

When a wettable powder containing 25 per cent. BHC (benzene hexachloride) was disked into soil at the rate of 1–2 lb. γ isomer and 3·5–7 lb. other isomers per acre three months before harvest, carrots, potatoes, sugar-beets and tomatos and the stems, but not the seeds, of maize grown in the soil showed contamination six months after harvest when tested by a method of bioassay using house-flies [*Musca domestica*, L.], though the amounts were less than 1 p.p.m. γ isomer equivalent in all cases. Taste was affected according to the amount absorbed. Melons, carrots, beans, potatoes and tomatos grown in soil containing 20–40 lb. DDT per acre from a 50 per cent. powder disked into the soil showed no contamination, but potatoes absorbed small amounts of parathion from soil treated with 0·45–0·75 lb. per acre in a 25 per cent. powder disked into the soil, and there was some evidence that tomatos also absorbed it.

Apples sprayed with Selocide (a proprietary insecticide containing selenium) showed residues not exceeding 0·5 p.p.m. in the flesh and whole fruit 6–9 weeks later [*cf.* **29** 559], and young wheat grown in soil that had been exposed to the drippings from sprayed trees four months or 1–3 years before showed results that did not differ much from the controls, indicating that selenium from this material is not absorbed either immediately after application or after a lapse of years.

Results of investigations on the absorption of BHC and DDT by cattle [B **37** 172 ; A **38** 21] and BHC by poultry [B **38** 154], which showed the efficiency with which DDT is absorbed into the milk and fat and the rapidity of absorption of BHC, are given for comparison.

WEAVER (N.). **The Toxicity of certain organic Insecticides to Honeybees.**—*J. econ. Ent.* **42** no. 6 pp. 973–975, 1 graph, 9 refs. Menasha, Wis., 1949.

The toxicity of arsenicals to honey bees is so great that when they were almost the only insecticides used for the control of cotton insects in Texas, the economic production of honey was impossible throughout much of the State. When new organic insecticides became widely used on cotton and also on leguminous crops, it was desirable to determine their toxicity to bees, and the contact effects of dusts containing DDT, BHC (benzene hexachloride), chlordan and toxaphene were tested by applying them to caged bees, which were transferred to clean cages containing food after 30 seconds. The dusts containing BHC proved very toxic. There was almost immediate loss of muscular control, and most of the deaths occurred on the first two days. The median lethal rates of application of dusts containing 3 per cent. γ BHC and 40 per cent. sulphur, with and without 5 per cent. DDT, were 1·9 and 2·3 lb. per acre, respectively ; the DDT in the mixture had increasing effect at higher rates. The median lethal rate of 5 per cent. DDT with 82 per cent. sulphur was 9·6 lb. per acre. The reaction of the bees to DDT was less immediate, but most of the mortality occurred on the first day. The toxicity of 10 per cent. chlordan with 40 per cent. sulphur varied greatly with the temperature ; the median lethal rate was 29·95 lb. per acre at 76°F., but much less at 86°F. Toxaphene was scarcely toxic, 20 per cent. with 40 per cent. sulphur giving only 5 per cent. mortality at 36 lb. per acre. A slight increase in the nervousness of dusted bees was the only other effect noted.

EDEN (W. G.) & ARANT (F. S.). **Control of the Imported Fire Ant in Alabama.**—*J. econ. Ent.* **42** no. 6 pp. 976–979, 5 refs. Menasha, Wis., 1949.

Solenopsis saevissima var. *richteri*, Forel, which has been a minor pest in the Gulf Coast area of Alabama for over 20 years, has recently spread to other areas and now occurs in at least ten counties in south-western Alabama and in Mississippi and Florida. With increasing numbers it has become more important and frequently attacks germinating seed and young, tender plants, builds unsightly mounds that may damage machinery and is a vicious stinger [*cf. R.A.E.*, A **38** 34]. Treatment with 3 oz. 48 per cent. calcium cyanide dust per hill, applied by digging into the mound, spreading the dust and covering it with soil, exterminated the ants in 80 per cent. of the mounds on 2,000 acres in Alabama in 1937, and Lyle & Fortune found that DDT, BHC (benzene hexachloride), toxaphene and chlordan were effective [**38** 35]. In 1949, DDT, toxaphene, BHC, aldrin [1, 2, 3, 4, 10, 10-hexachlor-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4, 5, 8-diendomethanonaphthalene], dieldrin [1, 2, 3, 4, 10, 10-hexachlor-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4, 5, 8-diendomethanonaphthalene] and chlordan gave good results in preliminary tests in

Alabama. Opening the nests and mixing the insecticide with the soil was the most effective method of application. When applied in this way, 0·5 U.S. pint 2·5 per cent. chlordan spray emulsion and 2 oz. of dusts containing 10 per cent. chlordan, 3 per cent. γ BHC with 5 per cent. DDT, 20 per cent. toxaphene or 2·5 per cent. aldrin all gave complete control and 2 oz. 1 per cent. dieldrin dust gave 90·6 per cent. control. The chlordan emulsion and dust were also introduced into 1–3 holes about 18 inches deep in the mound, but with poorer results. In some areas, where there were 50 mounds per acre, broadcast applications were tested. More than 90 per cent. control was obtained when 2–4 lb. chlordan was applied per acre in 5–10 per cent. dusts or 2·5 per cent. emulsion spray, provided that the soil was disked before or afterwards. Considerably less control resulted from dusts when the soil was not disked, but emulsion sprays were almost as effective without disking as with it. When applied as a dust without disking, 1 lb. aldrin per acre was less effective than 2 lb. chlordan.

WENE (G. P.). **Control of the Suckfly on Tomato.**—*J. econ. Ent.* **42** no. 6 p. 983, 2 refs. Menasha, Wis., 1949.

In 1947 and 1948, the Mirid, *Dicyphus minimus*, Uhl., was present in tomato fields in the Lower Rio Grande Valley of Texas in small numbers without causing appreciable damage, but during the spring and early summer of 1949 it increased and became injurious in practically all tomato fields in which control measures were not applied. Two experiments on its control with dusts applied at the rate of about 35 lb. per acre were therefore carried out during the harvesting period.

In the first, the numbers of Mirids in ten sweeps of the net one and seven days after dusting averaged 0·1 and 8·3 for 1 per cent. lindane [at least 99 per cent. γ benzene hexachloride] in talc, 0 and 3 for 5 per cent. methoxy-DDT (methoxychlor) in talc, 72 and 26 for 5 per cent. DDT in talc, 1·7 and 8·3 for 5 per cent. DDT with 82 per cent. sulphur, 101·7 and 70·3 for sulphur alone, and 143·7 and 186·3 for no treatment. In the second, the numbers per 20 sweeps one and nine days after dusting averaged 0 and 24·3 for 1 per cent. parathion in talc, 0 and 3·7 for 10 per cent. toxaphene with 40 per cent. sulphur, 1·7 and 7 for 5 per cent. chlordan in talc, 13 and 3·3 for 5 per cent. DDT with 82 per cent. sulphur, 99 and 262 for 5 per cent. DDD (dichlordiphenyl-dichlorethane) in talc, and 173·3 and 601·7 for no treatment.

GILLOGLY (L. R.). **Interference of Sulphur with Bioassay Dip Test.**—*J. econ. Ent.* **42** no. 6 pp. 983–984. Menasha, Wis., 1949.

The author describes a very sensitive technique for the bioassay of insecticides. An acetone solution or extract of the product containing 50–100 times the concentration of insecticide to be used in the test is diluted with distilled water to produce a very finely divided suspension of the desired concentration. A shell vial containing house-flies [*Musca domestica*, L.] of test age and covered with cheese cloth is half filled with the suspension and shaken vigorously 25 times (15 seconds) to wet each insect thoroughly and evenly, the excess suspension is flipped out, and the wet flies are kept in a clean cage for 24 hours before the mortality count. House-flies can be shaken for as long as a minute in water containing up to 10 per cent. acetone without any significant mortality, but it is advisable to keep the percentage of acetone at about 1–2.

In recent tests of commercial agricultural dusts containing DDT, it was observed that the presence of sulphur reduced the kill. Further investigation showed that a concentration of DDT sufficient to give complete mortality

without sulphur gave about 10 per cent. when sulphur was present in the acetone solution, though flies shaken first in a sulphur suspension and then immediately in DDT suspension showed no reduction of mortality and there was none in dips prepared from extracts made with aniline instead of acetone. When aliquots of dips were dried in petri dishes and flies were exposed to the residues, there was slightly higher mortality in the dishes that contained sulphur.

In a series of tests, the median lethal dilutions per ml. of p,p'DDT, DDD (dichlordiphenyldichlorethane) and methoxy-DDT (methoxychlor) were 10, 20 and 40 mmg. without sulphur and 80, 70 and 50 mmg. with it, and that of lindane [at least 99 per cent. γ benzene hexachloride] was very slightly increased from 1 mmg. by the addition of sulphur.

FRANKLIN (H. J.). **A new Cutworm on Cranberry.**—*J. econ. Ent.* **42** no. 6 p. 986, 3 figs., 1 ref. Menasha, Wis., 1949.

Various cutworms attack cranberry in Massachusetts after the removal of the winter flood ; the one here recorded for the first time as doing so is *Hyppa xylinoides*, Gn., which was found with black cutworms [*Agrotis ypsilon*, Hfn.] and armyworms [*Cirphis unipuncta*, Haw.] in a bog at Carver on 24th June 1949, a month after the winter water had been removed. The larva, cocoon and adult are described. The cocoons were made on the surface of the bog sand or a little way up on the plants. Pupation began on 1st July, and adult emergence occurred between 11th and 25th July.

DAHM (P. A.) & PANKASKIE (J. E.). **A Biological Assay Method for determining Aldrin.**—*J. econ. Ent.* **42** no. 6 pp. 987–988, 6 refs. Menasha, Wis., 1949.

The bioassay method described consists essentially of exposing uniform samples of adults of *Musca domestica*, L., to residues containing known and the unknown amounts of aldrin [1, 2, 3, 4, 10, 10-hexachlor-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4, 5, 8-diendomethanonaphthalene] for 48 hours and comparing the resulting mortality rates. This is done by plotting the mortality percentages as probits against the logarithms of the known dosages (expressed in mg. per kg. flies) to establish a standard assay curve, from which the quantities of insecticide in the unknown residues are determined.

In preparing the standard curve for each day's analyses, sufficient quantities of a standard benzene solution containing 3 mmg. aldrin per ml. are pipetted into the bottom of clean dry wide-mouthed jars with an area of about 44 sq. cm. to deposit 1, 2, 3, 4 and 5 mmg. aldrin per jar, after which 1 ml. of a benzene solution containing 20 mg. maize oil per ml. is added to each jar to prevent possible loss of the test compound by evaporation and to simulate the fatty or waxy residues obtained from extraction of animal and plant tissues in benzene and ether, and also to an untreated jar. When the solvent has evaporated, house-flies are anaesthetised with carbon dioxide and weighed and about 100 (2 gm.) are transferred to each jar. Milk absorbed by a cellulose material is provided for food, and the jars are covered with cheesecloth. Mortality counts are made after 24 and 48 hours. Appropriate amounts of the extracts containing unknown amounts of aldrin are put in other jars and tested in the same way.

The results of the standard assays showed that the median lethal dose was 1·1–1·66 mg. aldrin per kg. flies. The mortality of the flies in the control jars was never more than 3 per cent. and usually 0–1 per cent. after 48 hours. The method allowed quantitative estimation of as little as 1 mmg. toxicant, and was used successfully to determine the presence or absence of aldrin in

animal tissues or products such as milk and on such forage crops as lucerne. Comparable extracts of normal animal or plant tissue were made and exposed to the flies, with no significant mortality.

Wood (S. L.) & Knowlton (G. F.). *Diachus auratus*, **a new Strawberry Pest in Utah.**—*J. econ. Ent.* **42** no. 6 p. 989. Menasha, Wis., 1949.

A five-acre strawberry field at Garden City, Utah, was heavily infested by adults of *Diachus auratus*, F., in 1948 and 1949. The beetles entered the field at about the beginning of the picking season and left at the end of it. They skeletonised the leaves and fed on the flowers at the base of the petals and the green fruits under the calyx caps ; a few were observed on partly ripened fruits, but none on ripe ones. Injured flowers and fruits died in 2–3 days ; more than 90 per cent. of the fruit was rendered unfit for market in 1948, and over 60 per cent. was damaged in 1949.

This Cryptocephalid is known as a willow flea-beetle, but on 21st June 1949, when it was abundant in only one part of the field, considerable sweeping of willows, wild rose bushes and other plants at that edge of the field revealed only two individuals, both on rose. None was found in or on the ground, either in the field or under rose bushes or willows, or in other strawberry fields, the nearest of which was 1½ miles away. On 6th July, the beetles were more active and more uniformly distributed over the strawberry field and nine individuals were collected on rose and five on willow. On 14th July, the beetles were rather scarce on strawberry, but quite abundant on rose blossoms on all sides of the field ; they were less abundant on willow. Extensive sweeping on all sides of the field did not reveal any beetles more than 30 ft. from the strawberries, and none could be found round the bases of strawberry, willow or rose or in the soil near them. The decrease in population continued until 16th August, when the beetles completely disappeared from strawberry and only one could be found on rose and one on willow. No males were observed in either year, and no signs of egg development in females that were dissected in 1949.

Taylor (E. J.). **A Life History Study of** *Nabis alternatus*.—*J. econ. Ent.* **42** no. 6 p. 991. Menasha, Wis., 1949.

Nabis alternatus, Parshley, was the most numerous predacious insect in many lucerne fields in northern Utah in the middle of the summer of 1948, when it and Coccinellids represented 41 and 25 per cent. of all predators collected. Adults were first found in Cache Valley on 13th May 1948, and they mated immediately and began to oviposit five days later. Caged females laid 90–200 eggs in an average of 20 days. The eggs were deposited singly within lucerne stems and hatched in nine days at temperatures of 67–88°F. Newly hatched nymphs were reared to maturity on *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), nymphs and adults of *Lygus elisus*, Van D., and *L. hesperus*, Knight, or thrips. The average numbers of Aphids and *Lygus* devoured per nymph were 80 and 29, respectively, and the duration of the nymphal stage ranged from 15 to 30 days. Newly hatched *Nabis* nymphs given only succulent lucerne did not feed and died within five days. Although nymphs invariably died when attempts were made to rear them on larvae of *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gylh.), adults were observed to feed on these both in the field and in the laboratory ; they also fed on *M. onobrychis*, *L. elisus*, *L. hesperus* and first- and second-stage grasshopper nymphs in the field.

In the laboratory, there were five nymphal instars and three generations in the year. Winter was apparently passed in the adult stage, mating occurring after the spring emergence.

The Tachinid, *Leucostoma atrum*, Tns., was the most numerous natural enemy of the Nabid in northern Utah in the summer of 1948, and many individuals parasitised by it were collected. The parasite larva emerged dorsally from the abdomen of the host, pupated and gave rise to the adult within 7–8 days.

RIHERD (P. T.). **Chlorinated Insecticides for Control of Cowpea Insects.**—*J. econ. Ent.* **42** no. 6 pp. 991–992. Menasha, Wis., 1949.

The results are given of two tests in 1948 to ascertain the cause of the failure of spring-planted cowpeas to set fruit along the Gulf Coast of Texas and to determine if *Bruchus pisorum*, L., could be controlled by early applications of insecticides. In the first, adults of the Pentatomids, *Nezara viridula*, L., and *Euschistus servus*, Say, migrated into the plots when the plants began to flower and fed on the blossom buds and young pods, and dusts of toxaphene, chlordan and pyrophyllite (10 : 5 : 85) and toxaphene, DDT and pyrophyllite (18 : 5 : 77) were applied twice, on 15th and 25th June. On 30th June, the numbers of blossoms and pods per 25 ft. of row were 555–639 after treatment with chlordan and toxaphene, as compared with 12–31 for no treatment, and 391–511 for DDT and toxaphene, as compared with 2–26 for no treatment. Only one Bruchid emerged from 2,000 dry peas that were collected from the treated plots on 13th July and stored ; no mature pods could be found on the untreated plots.

In the second test, a dust containing 10 per cent. sabadilla, two containing 0·5 per cent. technical piperonyl cyclonene and 0·05 per cent. pyrethrins, with and without 0·25 per cent. rotenone, respectively, and one containing 0·12 per cent. rotenone with 0·5 per cent. technical piperonyl cyclonene were applied at 25–30 lb. per acre on 15th and 29th June. There was no early infestation by Pentatomids, but a light one developed when most of the pods were nearly mature. General observations indicated that they caused about the same amount of damage on all treated and untreated plots. Large numbers of Bruchids emerged from stored dried peas from all plots, with no significant difference due to treatment.

It is concluded that the failure of spring-planted cowpeas in the Gulf Coast area is due to the feeding of Pentatomids, and that both these and *B. pisorum* can be controlled with chlorinated insecticides, though the danger of toxic residues would prevent the use of treated cowpeas for human consumption.

RIHERD (P. T.). **DDT and Benzene Hexachloride to control Southern Corn Rootworm.**—*J. econ. Ent.* **42** no. 6 pp. 992–993. Menasha, Wis., 1949.

The southern corn rootworm [*Diabrotica undecimpunctata howardi*, Barber] caused severe damage to seedling maize and grain sorghum along the Gulf Coast of Texas in 1947 and 1948 and is apparently becoming increasingly important. The larvae attack the seedlings from the time of germination until they are 6–8 inches high. The bigger plants usually survive but are stunted. The soil in which maize was sown on 31st March 1948 was treated with dusts of 5 per cent. DDT or γ BHC (benzene hexachloride) in pyrophyllite at the rate of 21·32 and 24·71 lb. per acre, respectively. The dusts were applied by following a horse-drawn planter with the spout of a fan-type hand duster directed between the covering ploughs. BHC caused severe plant injury, most of the seedlings dying in a short time ; it caused no injury when applied above the seed, but no data on control were secured for this method. DDT caused no plant injury and appeared to stimulate growth. When the maize had reached a stage of

growth at which injury was no longer noticeable (20 days after sowing), the numbers of plants per 200 ft. of row were 85·25 on plots treated with DDT, 51·5 on untreated ones and 9·25 on those treated with BHC, the differences being highly significant.

Young (M. T.) & Garrison (G. L.). **Aphid Collections at Tallulah, Louisiana, from 1941 to 1947.**—*J. econ. Ent.* **42** no. 6 pp. 993–994. Menasha, Wis., 1949.

In the course of collections made at irregular intervals on plants other than cotton growing in fields in which cotton had been grown the previous season or on neighbouring ditch banks and roadsides at various places within 15 miles of Tallulah, Louisiana, *Aphis gossypii*, Glov., was taken on 21 species, records for which are given.

On cotton, *A. gossypii* was usually present from the seedling stage until the plants were defoliated by frost, but in 1942 it was not found until 29th June, Aphids collected before that date being *A. medicaginis*, Koch, *Macrosiphum solanifolii*, Ashm., and *Myzus persicae*, Sulz. On cotton in 1941–47, *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) and *M. solanifolii* were collected only in April and May and *Myzus persicae* in April, May and June ; *A. medicaginis* was taken in April and May in most of the years, and also in June, July and October in 1945 and June in 1947, and *Rhopalosiphum subterraneum*, Mason, was taken on the leaves in May in 1944 and 1947.

Munro (J. A.) & Post (R. L.). **Control of Boxelder Bugs.**—*J. econ. Ent.* **42** no. 6 p. 994, 1 ref. Menasha, Wis., 1949.

Tests on the control of *Leptocoris trivittatus*, Say, were carried out in North Dakota in the third week of September, when the insects were congregating in masses on the trunks of boxelder trees [*Acer negundo*] and on weeds and the sunny sides of buildings, and invading houses with inadequate screening or poorly fitting doors and windows ; only 12 per cent. had reached the adult stage. Aqueous sprays made from emulsion concentrates and containing 2 per cent. chlordan, lindane [at least 99 per cent. γ benzene hexachloride], toxaphene or CS-645A (a new nitroparaffin compound) were applied with a knapsack sprayer to the tree trunks and sides of buildings where the bugs were most abundant and caused 52, 70, 30 and 85 per cent. kill within one hour and 97, 95, 90 and 75 per cent. in 48 hours. Similar sprays containing 1 and 2 per cent. DDT gave 10 and 60 per cent. kill in 24 hours and 30 and 80 per cent. in 48 hours.

Nickels (C. B.). **Some minor Insect Pests of Pecan in Texas.**—*J. econ. Ent.* **42** no. 6 pp. 994–995. Menasha, Wis., 1949.

The author gives a list of 26 species of insects taken on pecan in Texas in 1918–48 in the course of studies on the more important pests, showing the parts of the tree on which they were found. Most of them were collected as larvae and reared in the insectary.

Smith (H. S.) & Flanders (S. E.). **Recent Introductions of entomophagous Insects into California.**—*J. econ. Ent.* **42** no. 6 pp. 995–996, 1 ref. Menasha, Wis., 1949.

Lists, showing countries of origin and hosts, are given of 34 species of insect parasites and predators that were introduced, propagated and released in California during the three years ending 30th June 1949, and of 25 that were

introduced but not propagated because the numbers were inadequate, the sexes were not received at the same time, or the host species were absent, scarce or not at a stage suitable for attack.

KENAGA (E. E.) & HUMMER (R. W.). **The Toxicity of some substituted Phenyl Benzenesulfonates to the Two-spotted Spider Mite and Mexican Bean Beetle.**—*J. econ. Ent.* **42** no. 6 pp. 996–997, 5 refs. Menasha, Wis., 1949.

In laboratory tests of the toxicity of 21 substituted phenyl benzenesulphonates and the unsubstituted parent ester, solid compounds were ground in a ball-mill for three hours in water containing a small amount of wetting agent, and liquids and semi-solids were made into emulsifiable concentrates by dissolving them in kerosene containing a suitable emulsifying agent. Beans with the primary leaves bearing eggs and adults of *Tetranychus bimaculatus*, Harvey, were dipped momentarily in dispersions of the preparations, and uninfested seedlings were similarly dipped and then infested with third-instar larvae of *Epilachna varivestis*, Muls. A range of concentrations was tested to find the lowest one causing 95–100 per cent. mortality, which was estimated six days after treatment. It was found that at the concentrations tested, the ovicidal activity was greatest when both rings of the ester were substituted with chlorine in the para position (4-chlorphenyl ester of 4-chlorbenzenesulphonic acid) and decreased to some extent when either one of the chlorine atoms was replaced by bromine and even more when both were replaced by bromine. The other compounds in the series were relatively ineffective. The phenyl benzenesulphonates were not sufficiently toxic to adult mites to make a correlation between acaricidal effect and chemical structure possible. Their toxicity to *Epilachna* larvae followed the same relationship to chemical structure as toxicity to the mite eggs, but the 4-methoxyphenyl ester of 4-chlorbenzenesulphonic acid, which was relatively ineffective against the mite eggs, was toxic to the larvae.

Field and laboratory tests have shown that the parachlorphenyl ester of parachlorbenzenesulphonic acid is an outstanding acaricide, being particularly effective against the eggs and active immature stages of several species of mites.

KENAGA (E. E.) **The Toxicity of some bis(substituted phenoxy) Methanes to the Two-spotted Spider Mite and Mexican Bean Beetle.**—*J. econ. Ent.* **42** no. 6 p. 998, 4 refs. Menasha, Wis., 1949. **The Toxicity of some substituted Phenyl Benzoates to the Two-spotted Spider Mite and Mexican Bean Beetle.**—*T.c.* pp. 999–1000, 3 refs.

The following is based on the author's summaries of these experiments, in which the compounds were tested against eggs and adults of *Tetranychus bimaculatus*, Harvey, and larvae of *Epilachna varivestis*, Muls., by the method already noticed [see preceding abstract]. In tests of 24 bis(phenoxy) methanes, the bis 4-chlor substitution seemed to be the best, bis(4-chlorphenoxy) methane being very toxic to all the stages tested and particularly effective against the mite eggs [*cf. R.A.E.*, A **36** 155 ; **37** 381 ; **38** 56]. Compounds containing the bis 2-allyl substitution, alone or in combination with other substitutions, appeared to be very toxic to the adult mites and the beetle larvae. Tests of some 20 phenyl benzoates showed that acaricidal action was greatest when chlorine was substituted on one or both rings of the compound in the para position and that there was most ovicidal action when chlorine was substituted on both rings in this position (4-chlorphenyl ester of 4-chlorbenzoic acid). The phenyl benzoates tested were not sufficiently toxic to *E. varivestis* to show any correlation of insecticidal activity and chemical structure.

POSNETTE (A. F.), ROBERTSON (N. F.) & TODD (J. McA.). **Virus Diseases of Cacao in West Africa. V. Alternative Host Plants.**—*Ann. appl. Biol.* **37** no. 2 pp. 229–240, 2 pls., 7 refs. London, 1950.

The following is partly based on the authors' summary of this paper of a series [*R.A.E.*, A **37** 232, 315], in which an account is given of laboratory and field studies on the alternative hosts of the viruses that cause swollen-shoot disease of cacao in West Africa. Laboratory tests were made with strains A, C and M from the Gold Coast [*cf.* **37** 85] and one from Offa Igbo in Nigeria, *Pseudococcus njalensis*, Laing, being used to test the susceptibility of 21 native plants to them. *Bombax buonopozense*, *Ceiba pentandra* and *Adansonia digitata* (all in Bombacaceae) and *Cola cordifolia*, *Erythropsis barteri*, *Sterculia rhinopetala* and *S. tragacantha* (all in Sterculiaceae) were found to be susceptible to one or more of these viruses, but were less affected than cacao ; some showed transient leaf symptoms and others were symptomless carriers. The development of spines on the stems of seedlings of *Ceiba pentandra* was suppressed by infection with strain A. In general, the indigenous plants were more difficult to infect than cacao, and the mealybugs did not become infective so readily when feeding on them as when feeding on infected cacao. The availability of the viruses to vectors seemed to be correlated with severity of symptoms, and transmission from infected plants to cacao became less frequent with increasing duration of infection. In the Western Province of the Gold Coast, *Cola chlamydantha* growing on cacao farms and in forests was found naturally infected with viruses that were apparently identical with those causing swollen shoot of cacao there, and these were transmitted to healthy cacao by the known vectors, *P. njalensis* and *P. citri*, Risso, and also by *P. masakensis*, James, and *Paraputo ritchiei*, Laing. Naturally infected *Ceiba pentandra* was found both in the Gold Coast and in Nigeria.

Of the plants susceptible to strain A, *Bombax buonopozense* is rarely attacked by the known vectors and colonies of *P. njalensis* placed on it did not breed, and *Adansonia digitata* usually grows in areas too dry for cacao, but *Ceiba pentandra* and *Cola cordifolia* occur commonly on cacao farms and are preferred food-plants of the vectors. There is little doubt that *C. chlamydantha*, which differs from other alternative hosts in that mature trees are as infective as seedlings and coppiced plants, is an important source of virus for cacao, and it, and other alternative hosts near cacao, should be destroyed wherever possible. This may present difficulties in the case of mature trees [**37** 173], but future trouble could be avoided by the eradication of seedlings and saplings. It has been found that *C. chlamydantha* is readily infected with any of the viruses from the Western Province of the Gold Coast or the Ivory Coast yet used and with strain J from Ashanti, but it has not been infected with strains A, C or M from the Eastern Province. The theory that strain C is a distinct virus unrelated to strain A [*cf.* **37** 86, 232] is supported by the present findings, since *Sterculia rhinopetala* was susceptible to the former, but apparently immune to the latter. Strain M is able to infect *S. rhinopetala* and also *S. tragacantha*, which, however, is resistant to strain C ; these strains produce widely differing symptoms, but show a similar vector range.

BARNES (H. F.). **The Identity of the Swede Midge, with Notes on its Biology.**—*Ann. appl. Biol.* **37** no. 2 pp. 241–248, 10 refs. London, 1950.

The following is based on the author's discussion and summary. Although Kieffer in 1912 identified the Cecidomyiid injuring the leaves of swedes in England as *Contarinia nasturtii*, Kieff., which he had originally described from the flowers of *Rorippa islandica* (*Nasturtium palustre*) and had also recorded from the flowers of rape, other continental authorities considered the gall-midge causing leaf damage on cabbage and other species of *Brassica* in Holland

and Germany to be *C. torquens*, de Meij. [*cf. R.A.E.*, A **20** 342] and also recognised a third species, *C. geisenheyneri*, Rübs., as causing flower damage on *Brassica* spp. It was considered by some, largely on morphological grounds, that these three species were synonymous, but few breeding experiments had been carried out.

Following the discovery in England in 1948 of the true *C. nasturtii* causing swollen and closed flowers on *Rorippa amphibia* (*Nasturtium amphibium*), preliminary experiments showed that midges from this source cause similar damage to swede flowers and that they are of the same species as those attacking the flowers of *R. amphibia* in Holland. Further preliminary experiments showed that swede midges derived from the leaf axils of rape in England cause typical damage to radish flowers in addition to breeding successfully on the leaves of turnip, swede, cabbage and radish. Male midges derived from flowers of *Rorippa* paired with females from the leaf axils of rape, and their offspring were successfully reared on flowers of *Rorippa* and on turnip leaves. This biological evidence confirms the previous supposition based on morphological grounds that the swede midge is *C. nasturtii* and will cause either flower or leaf damage. Consequently, *C. torquens* and *C. geisenheyneri* must be regarded as synonyms of it.

In an unheated open glasshouse at Harpenden in 1949, the shortest time required for a generation of *C. nasturtii* (from parent to first adult offspring) to develop was 24–39 days during June–July, and the shortest time for the next generation, which developed during late July and August, was 29–32 days. Strong evidence of the production of unisexual families was obtained, constituting the first record of this phenomenon in the genus *Contarinia*.

EDWARDS (E. E.) & EVANS (J. R.). **Observations on the Biology of** *Corymbites cupreus* **F. (Coleoptera, Elateridae).**—*Ann. appl. Biol.* **37** no. 2 pp. 249–259, 13 refs. London, 1950.

The following is largely the authors' summary. The life-history of *Ctenicera* (*Corymbites*) *cuprea*, F., is described and its economic importance is assessed from field observations and laboratory experiments made in South Wales during 1941–43. The females are on the wing in May and June, and eggs are laid in June and hatch in about 34 days. The larval stage probably occupies five years under field conditions, and pupation occurs towards the end of July or beginning of August. The adults emerge about 21 days later, but they do not always remain in their earthen pupal cells until the following spring, as do several other Elaterids. The larvae feed principally on the roots and underground stems of plants, but they can exist on decayed organic matter in the soil. Individually they are far more injurious to potatoes, cereal and other crops than the larvae of either *Agriotes* spp. or *Athous niger*, L., but they are seldom pests of major importance because they are restricted to comparatively high altitudes. Birds and Carabid larvae readily feed on them, and they are also attacked by an unidentified Hymenopterous parasite and the fungi, *Metarrhizium anisopliae* and *Synglіocladium cleoni*. Attempts to infect larvae by keeping them in pots in soil heavily impregnated with these fungi and, in some cases, also with a larva recently killed by *M. anisopliae* were unsuccessful ; all those found naturally infected were in the last instar, and it is possible that they are only susceptible to attack at certain stages.

MILES (M.). **Observations on the Biology and Control of Cabbage Root Fly,** *Erioischia brassicae* **(Bché).**—*Ann. appl. Biol.* **37** no. 2 pp. 260–267, 7 refs. London, 1950.

The following is partly based on the author's summary of the work described, which was carried out in south-eastern England in 1948 and 1949.

Egg-laying by *Hylemyia* (*Erioischia*) *brassicae*, Bch., began in the third week of April and was at its maximum in the last week of April and the first week of May. From then on to early October, small numbers of eggs were continually present about cruciferous crops. Egg counts showed up to 141 eggs per plant on cauliflowers at the end of April and up to 117 eggs on spring cabbage on 6th May ; the flies showed no preference for newly set plants. Eggs on the soil were almost exclusively those of *H. brassicae* ; eggs on the plants were mainly those of *H.* (*Pegohylemyia*) *fugax*, Mg., with small numbers of *H. brassicae* and *H.* (*Delia*) *cilicrura*, Rond. Larvae were found continuously from the fourth week of April to mid-January, those found in December and January having hatched in the previous autumn. Larvae, up to 81 per plant, at the roots of the crops were almost exclusively *H. brassicae*, though a few of *H. fugax* and *H. cilicrura* occurred. A technique for separating larvae from the soil and plant roots is described. Great variation in the size of the puparia was noted. Small puparia (4–4·5 mm. long) were heavily parasitised by Cynipids.

In experiments on control, a dust containing 4 per cent. mercurous chloride (calomel) applied round the bases of the plants at about 80 lb. per acre was compared with two commercial dusts containing unspecified amounts of benzene hexachloride, referred to as flea beetle dust and wireworm dust, respectively, that were similarly applied. There were no untreated plots. In a test in which early cauliflowers were treated in April, the numbers of larvae and puparia found at the roots during the first week in June averaged 40·8 for flea beetle dust at 17 lb. per acre and 6·5 for mercurous chloride, and in another in which brussels sprouts were treated in early June, the numbers found between 20th July and 30th August averaged 4·8 and 13·5 for wireworm dust and flea beetle dust, respectively, at about 40 lb. per acre, and 4·1 for mercurous chloride.

Johnson (C. G.). **The Comparison of Suction Trap, Sticky Trap and Tow-net for the quantitative Sampling of small airborne Insects.**—*Ann. appl. Biol.* **37** no. 2 pp. 268–285, 8 figs., 12 refs. London, 1950.

The following is almost entirely the author's summary of comparative tests of the effectiveness of an adhesive trap [*R.A.E.*, A **38** 355], a suction trap [**38** 296] and a stationary aerial tow-net [**27** 167 ; **35** 132] in collecting accurate samples of small air-borne insects. The adhesive trap and stationary tow-net catch insects that fly on to them or are blown against them by the wind and are likely to be inefficient in light winds or in calm weather. Even though their efficiency should increase with stronger winds, errors of unknown magnitude may occur not only in estimations of density and of proportions of species in the air, but also with comparisons of actual catches. These errors are due to unknown degrees of weighting, as the traps sample by means of a variable wind from a changing population density. The suction trap, on the other hand, samples a constant quantity of air in all relevant wind-speeds and does not appear to suffer as seriously from these disadvantages. It also works efficiently in perfectly calm weather when maximum densities of insects are often in the air.

The performances of the three traps in the field operating over a range of wind-speeds are described. Particular attention was paid to Aphids, for which the adhesive trap and tow-net are generally used and for which the suction trap was primarily designed. Density estimates of Aphids in winds below about three miles an hour are much larger when calculated from suction-trap catches than when estimated from adhesive-trap and tow-net catches. There is reason to believe that the suction trap is neither attractive nor repellent to Aphids to a significant extent, and that it catches these insects at random by virtue of its air-stream alone ; weighting of catches due to variable quantities of air being sampled does not occur. It is considered, therefore, that the suction-trap

values of density are likely to be the more accurate ones. Evidence was obtained from the catches of small insects other than Aphids that the efficiency of the traps may vary for different kinds of insects.

JONES (J. M.). **Clover Seed Weevils.**—*Ann. appl. Biol.* **37** no. 2 pp. 313–320, 12 refs. London, 1950.

The developing ovules of red clover (*Trifolium pratense*) in Wales are attacked by the larvae of *Apion trifolii*, L. (*aestivum*, Germ.), *A. apricans*, Hbst., and *A. assimile*, Kby. An account is given of the bionomics of *A. trifolii*, which is typical of the three [*cf. R.A.E.*, A **17** 438], and of experiments in Montgomeryshire on the control of the weevils on late-flowering red clover, on which *A. trifolii* is the dominant species. The usual practice with late-flowering persistent red clover is to take a hay crop in the first year, use the field for grazing in the following spring, and harvest the seed in September [*cf.* **17** 439] ; and though some growers take seed cuts in the first year, this has not avoided serious loss caused by *Apion*. Various cultural and chemical control methods have been recommended against the weevils [**17** 439 ; **24** 440 ; **25** 306 ; **26** 75, 308, 475], but in Montgomeryshire, an application of derris dust at 56 lb. per acre at the end of May or the beginning of June, after the swards had been grazed bare, proved effective and became a routine measure. In 1943 and 1944, however, when derris became difficult to obtain, seed crop losses rose as high as 50–70 per cent. DDT and BHC (benzene hexachloride) were therefore tested in 1945–47. In 1945, a dust containing 2·5 per cent. BHC was applied at 56 lb. per acre in the first week of June to plots in fields that had been grazed bare. In assessing the results, counts of the numbers of larvae and pupae extracted from the flower heads by a modification of the flotation technique for extracting wireworms from soil [**34** 329, etc.] proved the most consistently reliable. Considerable reductions in infestation were obtained, but the true effects were masked by migration of the weevils. The trials were repeated in 1946, when the size of the treated plots was greatly increased and that of the controls decreased in order to minimise this factor. Samples of heads in full flower were taken on two occasions during August, and the percentage reduction of infestation varied from 42 to 88, with a mean of 71, on the first and from 65 to 87, with a mean of 73, on the second; average infestation on the controls was about the same as in 1945. Small-scale comparative tests of DDT, BHC and derris were also made. The results were inconclusive, but showed that infestation was twice as great near the hedges as in the centre of the field. In 1947, dusts containing 2·5 per cent. BHC and 2 per cent. DDT were applied to plots in the first week of June and reduced infestation by 25–92 and 46–63 per cent., respectively. Populations were considerably lower in that year, and as they continued at a low level in subsequent years, no further tests were made. Observations in two fields in each of which half the crop was cut for hay in early July and the remainder left for seed showed that populations in the seed crop were 10–12 times as high near the hay crop as at the end farthest from it, that they decreased gradually with increasing distance from the hay crop, and that they became normal at a distance of 40–50 yards.

The following recommendations are made. Infestation can be reduced by cutting the hay crop when about 25 per cent. of the flower heads are in full bloom. In the case of early, non-persistent varieties, in which both hay and seed crop are taken in the first year, this measure is of value in the individual fields, but in the case of persistent varieties that are not normally cut for hay in the seed-harvest year, it is necessary to cut all hay crops at the optimum time and aim at a general reduction of populations within an area. Seed crops should not be grown close to hay crops or haystacks, and should be surrounded by non-susceptible crops and be grown on land that carried and was surrounded

by such crops in the previous year. Where the amount of leaf injury caused by the adults in spring indicates the desirability of employing chemical control, dusts containing 2·5 per cent. BHC or 2 per cent. DDT should be applied.

Koegel (A.). **Nutztierparasitologie für Tierärzte, Landwirte und Nutztierhalter. Band I. Protozoologie und Entomologie unter Mitarbeit von Hermann Bollow.** [Parasitology of useful Animals for Veterinary Surgeons, Farmers and Keepers. Volume I. Protozoology and Entomology, with the Collaboration of Hermann Bollow.]—$9\frac{1}{2} \times 6\frac{1}{4}$ ins., vii+339 pp., 130 figs., 103 refs. Stuttgart, F. Enke Verlag, 1950. Price 30 *DM.* unbound; 32.70 *DM.* bound.

This book [*cf. R.A.E.*, B **38** 160] includes notes on *Nosema* spp. in silkworms (*Bombyx mori*, L.), honey bees and bumble bees, and on the morphology and habits of *Acarapis woodi*, Rennie, and insects that attack honey bees, chiefly in Germany.

Schwerdtfeger (F.). **Grundriss der Forstpathologie.** [The Outlines of Forest Pathology].—$9\frac{1}{2} \times 6\frac{1}{2}$ ins., xii+197 pp., 139 figs. Berlin, &c., P. Parey, 1950. Price 13.60 *DM.*

This textbook on the pathology of forest trees in Germany is divided into three main parts. The first comprises a general review of the various biotic and abiotic factors that cause injury to them, followed by sections on the insects, fungi and other organisms that attack individual classes of trees, saplings and nursery stock, the various causes, including infestation by insects, that lead to deterioration of the wood, and the insects, birds and small mammals that destroy the seeds. Concise accounts are included of the morphology and bionomics of the insects. The second part deals with the origin, course and effects of outbreaks, and the third with methods of forecasting and preventing them and cultural, physical, chemical and biological methods of control. Both are concerned very largely with insect pests.

Wichmann (H. J.), Patterson (W. I.), Clifford (P. A.), Klein (A. K.) & Claborn (H. V.). **The Determination of DDT as Spray Residue on fresh Fruit. Three independent Methods.**—*J. Ass. off. agric. Chem.* **29** no. 2 pp. 188–218, 4 figs., 20 refs. Menasha, Wis., 1946.

The authors describe three methods of determining DDT residues on fruit and discuss them in detail. For each method of analysis, the residue is removed from the fruit with benzene, which is shaken with anhydrous sodium sulphate and " filter cel " to dehydrate it and remove any entrained inorganic chlorides, and then filtered. It was shown that there was negligible penetration of DDT through apple skin.

The first method (described by Klein & Wichmann) consists of titrating the labile chlorine, which is converted to inorganic halide by refluxing with alcoholic potassium hydroxide, or the total chlorine, which is removed by refluxing with metallic sodium in the presence of isopropyl alcohol as catalyst. These chlorine methods are not specific for DDT, but the ratio of labile to total chlorine (1 : 5 for DDT) will be altered by the presence of other chlor-organic compounds to the extent to which they yield different percentages of their total chlorine under the test for labile chlorine. The second method (by Clifford) is an application of the Schechter and Haller colorimetric procedure for determining total DDT [*cf. R.A.E.*, A **35** 412]. The third method (by Claborn & Patterson) is a colorimetric method based on three separate chemical reactions, the conversion of p,p'DDT and o,p'DDT to the corresponding ethylenes, the oxidation of the ethylenes to the dichlorbenzophenones, and the conversion of the dichlorbenzophenones to the 2,4-dinitrophenylhydrazones. These last

derivatives yield colours in alkali that are qualitatively identical but differ quantitatively by about 10 per cent., the p,p′isomer giving the higher value. In commercial forms of DDT, however, the error due to the assumption that both isomers give the same colour intensity is negligible in comparison with other unavoidable experimental errors. The method may be used to determine DDT in the presence of its potential decomposition products (1,1-dichlor-2,2-bis(chlorphenyl)ethylenes and dichlorbenzophenones) or to determine DDT or any one of these products separately in mixtures of the three.

Results of the analysis of the same strip solution by the three methods showed good agreement, and no serious interference due to the presence of other organic matter was encountered in the analysis of residues from fruit sprayed with DDT. It is considered that the determination of total chlorine is probably the best for routine analyses where complications are not expected. The determination of total DDT permits a calculation of the proportions of the two isomers with maximum errors of about 2 per cent. The third method will probably never be used in routine work, but will be extremely useful as a check on either or both of the others. Its greatest advantage lies in the analysis of mixtures of DDT with two of its decomposition products.

Wichmann (H. J.), Patterson (W. I.), Clifford (P. A.), Klein (A. K.) & Claborn (H. V.). **Decomposition and Volatility of DDT and some of its Derivatives.**—*J. Ass. off. agric. Chem.* **29** no. 2 pp. 218–233, 1 fig., 6 refs. Menasha, Wis., 1946.

It has been shown that DDT may lose its toxic effect within two weeks when used as a spray under summer field conditions. Possible reasons for this are mechanical removal by wind and rain, volatilisation, decomposition resulting from the action of sunlight (presumably the ultraviolet rays in it) or from contact with other substances, and such effects as penetration into the interior of the fruit, occlusion in the apple waxes or simple attentuation of the deposit as the apple grows. As DDT is known to be readily decomposed under suitable conditions in the presence of certain catalysts, it seems possible that decomposition products, perhaps of unknown toxicity, may be present in spray residues on foods. Since their presence in any substantial amount would complicate the application of the three methods of analysing spray deposits recently described [*cf.* preceding abstract] attempts were made to discover decomposition trends that would furnish some evidence of the fate of DDT in spray residues.

Exposure to ultraviolet light had no effect on pure crystalline p,p′DDT, p,p′-dichlordiphenyldichlorethylene, or p,p′-dichlorbenzophenone, but DDT in solution was decomposed, and when DDT crystals were moistened with benzene at the beginning of exposure, decomposition had usually progressed to the point at which a yellow amorphous film was deposited by the time the solvent had evaporated, and at least half the DDT was changed into other substances within a few hours. Under these conditions, the ethylene changed even more rapidly, but the ketone was unaffected, and its tendency to crystallise during the evaporation of the solvent could not be prevented. The results obtained by the three methods of analysis or modifications of them or by bioassay against house-flies [*Musca domestica*, L.] showed that the p,p′DDT underwent profound chemical changes and that more than one mechanism was probably involved ; that p,p′-dichlordiphenyldichlorethylene was even less stable and had a decomposition product containing significant amounts of labile chlorine, although it contains none itself ; and that p,p′-dichlorbenzophenone was apparently stable to ultraviolet light.

When pure p,p′DDT was mixed with pyrophyllite, Triton X-100, Velsicol AR 60 and apple wax (the residue obtained on evaporation of the dried and

filtered benzene washings of market apples) and the mixture was exposed to sunlight from late June to October, analysis by modifications of the first two methods and bioassay indicated progressive decomposition of the DDT, though there was some disagreement as to its extent. All methods left an undetermined fraction, and variations in the results obtained indicated the presence of another decomposition product that distorted the ratio of labile to total chlorine in the first method of analysis and reacted as the ketone in the second, suggesting that the decomposition may proceed by various routes and that the ketone derivative is the end-product of only one. Part of the DDT was apparently lost by volatilisation as a chlorine-containing decomposition product. As such abnormalities had never been observed on actual samples of fruit sprayed with DDT, pure p,p′DDT was exposed for three months with nothing but an equal quantity of apple wax. Decomposition was definite but much less marked, and there was no evidence of colour-producing by-products. In case the DDT residue was sheltered from the effect of direct sunlight by the apple wax, it was also exposed in a translucent solution in an inert mineral oil. The results were similar to those obtained in the presence of apple wax ; there was notable disappearance of DDT, but no appearance of reacting by-products. Decomposition was more rapid, possibly owing to the translucency of the solution, although the experiment was performed later in the summer. A similar series of experiments with p,p′-dichlordiphenyldichlorethylene resulted in more rapid decomposition, the progressive appearance of nonreacting material and the slow appearance of labile chlorine, as shown by analysis by the first two methods. It is possible that the ventilation of the exposure dishes may have been inadequate to allow such escape of decomposition products as would occur under normal field conditions.

When subjected to a temperature of 130°F. for 17–18 days, pure p,p′DDT showed least volatility (3·5 per cent. loss of weight) and the ketone derivative was less volatile than pure o,p′DDT. The p,p′ethylene lost weight rapidly, particularly if it had been treated with a little benzene and ultraviolet irradiation for 1½ hours before heating ; p,p′DDT that had received preliminary ultraviolet irradiation for 1½ hours, so that it lost 5 per cent. weight and decomposed to a brownish oil, became whiter and began to crystallise as the experiment progressed. At the same time, the rate of loss of weight became slower until it was about equal to that of pure p,p′DDT. When a mixture of the p,p′ and o,p′ isomers of DDT (3 : 1) was dissolved in benzene, dried and exposed to heat, the loss of weight was similar to that of o,p′DDT. Analysis of the residue left at the end of the experiment by the first two methods indicated that weight loss was due to simple volatility or that such decomposition products as were formed were volatilised rapidly and completely. Recovery of o,p′DDT tended to be slightly lower than the actual weight of residue. The instability of o,p′DDT in the mixture was shown by the alteration of the proportion of isomers to 87 per cent. p,p′ and 13 per cent. o,p′DDT. The sample of p,p′DDT that had received initial irradiation did not contain excessive inert material, but the ethylene was largely converted to non-reacting material by preliminary irradiation. These results indicate that p,p′DDT is less volatile than several of its possible decomposition products.

Analyses of residues on apples sprayed four times with 6 lb. Deenate (1 part technical DDT and 3 parts clay with a little sodium lauryl sulphate as wetting agent) per 100 U.S. gals., with bentonite and hydrated lime as adhesives, agreed with previous results on sprayed apples in that abnormal chlorine ratios by the first method and abnormal colours by the second were not found. The experiments with ultraviolet light and sunlight show that decomposition products capable of drastically interfering with the methods of analysis are produced, but apparently their volatile nature assures their removal under ordinary circumstances about as fast as they are formed.

BRITISH STANDARDS INSTITUTION

Recommended Common Names for Pest Control Products

At the beginning of this year, the British Standards Institution made the widespread announcement in the technical and trade press that a Technical Committee had been appointed to devise simple, common names for well-established pest control products (including insecticides, insect repellents, acaricides, nematocides, fungicides, herbicides and rodenticides). The need for common names which do not conflict with proprietary names was pointed out on account of the considerable confusion which has arisen in commercial descriptions and in the technical literature.

The B.S.I. now announce that this Technical Committee has prepared the first list, containing some 25 common names for the better-known products now in general use in agriculture and in veterinary circles throughout the country. This list is being circulated for technical comment among Government departments, manufacturers and the interested scientific societies before final publication. In order to pre-empt the use of these names as proprietary names, the list has been lodged with, and approved by, H.M. Patent Office. The names will be given protection and will be referred to when application is made for the registration of proprietary names for pest control products.

Wherever possible, the names adopted conform with those already accepted as coined common names by the U.S. Department of Agriculture, and the same system of protection is given by the U.S. Patent Office. It is hoped that the same measures will extend to other countries in due course.

The chemical names assigned to each compound are in accordance with the principles recommended by the Chemical Society. Where possible, only the pure active ingredients have had common names assigned to them, and an endeavour has been made to avoid, with a few outstanding exceptions, the use of initials and numbers. These exceptions are made in the cases of compounds which are already well known by initials, such as DDT and BHC, since a further name would only increase the confusion.

During the drafting, the Technical Committee has maintained liaison with the Commonwealth countries as well as with the appropriate committee in the United States.

CM (PCC) 4253 : 16*th August*, 1950.

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by the South Essex Recorders, Ltd., Ilford.

(899) Wt. P2701/3853 11/50 S.E.R. Ltd. Gp. 432.